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LEAP INTO THE UNKNOWN

CONFRONTED by problems when we were growing up, how many of us were reassuringly told: "It's not rocket science"?

They seemed to be sage words at the time. The problem is, when it comes to motorsport's next step, it would appear that it really *is* rocket science!

Liquid hydrogen, stored at -253 degrees, is best known for its role in space exploration as rocket fuel, but it does offer a compelling solution for sustainable motorsport. With zero tailpipe emissions and high energy density by weight, it enables long race durations and fast refuelling, addressing the limitations of battery-electric vehicles in endurance and high-intensity motorsport formats.

Hydrogen also aligns with broader automotive trends, potentially spurring innovation and infrastructure development beneficial to road transport.

Yet if the 'pros' column is appealing, then the 'cons' are rather daunting. The prospect of hydrogen motorsport has remained on the horizon, shimmering like a mirage, for many years now. The principal reason for that is simply that motorsport hasn't been ready for its own moonshot.

For years now, any mention of hydrogen has been all-too-easily rebuffed by the rather exasperated complaint that we don't even have any regulations in place yet. Well, now those guidelines *do* exist, which makes our feature this month with the FIA's key players in this area well worth a read (page 24).

It reveals that an unprecedented amount of research has gone into determining standards for the use of this embryonic technology. The aim has sensibly been to formulate generic regulations that could potentially be adapted to any of the FIA championships in the future.

We know that Extreme H (see lead news spread) will be first out of the blocks. Hydrogen will inevitably find a home in the World Endurance Championship too. But wouldn't it be great if it could be adopted in truck racing? Surely that could really drive change in a haulage sector that could potentially benefit big-time?

A key point is that motorsport's governing body isn't just fixating on the one approach. It is making space for competing technologies within a portfolio that will also include battery electric powertrains, hybrids and other sustainable energy carriers.

Just as there is no magic one-size-fits-all solution in the real world – a concept that our politicians sometimes find difficult to grasp – motorsport needs different solutions that will work for a wide range of championships, from Formula 1 down to grassroots.

Critics will argue that laying the foundations for hydrogen technical regulations has been painfully slow. And it has. But necessarily so, because the technology we are dealing with is so tricky and the stakes so high.

Mark Skewis
EDITOR

Don't mention the 'H'-word!

Confidence in hydrogen is haunted by the Hindenburg, but Extreme H is on a mission to banish negative perceptions of the technology. By **Mark Skewis**

WHAT image leaps to your mind when you hear the word "hydrogen"?

For the boards of the major automakers, hydrogen surely conjures the thought of dollars. Lots of them.

After all, the global hydrogen fuel cell vehicle market is predicted to grow from $2.55 billion in 2024 to $17.73 billion by 2034.

And yet... Sales of hydrogen-powered vehicles fell around the world by more than 20% for the second year in a row in 2024, according to new figures. A total of 12,866 fuel-cell electric vehicles (FCEVs) were sold globally last year, compared to 16,413 in 2023 — a 21.6% fall.

Hydrogen fuel cells are nothing new – they powered America's race to the moon back in the Sixties – but their uptake in the automotive sphere hasn't always gone to plan.

Theories for those disappointing figures? You could point to the growth of BEVs, perhaps? Or worries over the refuelling infrastructure?

Yet there is another factor. The elephant in the room, if you like. Public confidence.

Extreme H technical director Mark Grain believes the Pioneer 25, which took its public bow at the Goodwood Festival of Speed last month, could help provide the answer.

"If you stop the average person in the street and start to talk to them about hydrogen, a film of a 100-year-old balloon instantly comes to their mind," says Grain. "What this championship can do is turn the tide on that, get people to start thinking about hydrogen in a different way; showcase it as the technology of the future, rather than a horror from the past.

"We can help manufacturers with that messaging: fans will see a car leaping 15 feet up in the air, then go through a massive compression and race wheel-to-wheel and, what do you know, they don't even blow up! We can help with the wider hydrogen messaging."

If you think Grain's reference to the Hindenburg

BELOW The Pioneer 25 is touted as the future of sustainable racing

disaster is absurd, you might have to think again. After all, he's the man tasked with selling the notion of a hydrogen fuel cell-powered race series to a sceptical public – and to OEMs acutely aware of the fact that hydrogen has been 'the fuel of the future' for decades.

The behavioural economist Dan Ariely, author of 'Predictably Irrational: The Hidden Forces That Shape Our Decisions', believes the impact of the airship disaster still shapes public perception.

He is on record suggesting that the hydrogen-Hindenburg association develops through an unconscious question-and-answer session: "What do I know about the risk of hydrogen? Let me try to remember past cases that used hydrogen? Oh, yes, I remember the Hindenburg explosion – very vividly. It thus must be the case that this is dangerous."

Consumers, he observed, tend to search their memories for dangerous examples, "and if they find one, they estimate the risk as much higher."

Changing perceptions

If banishing such fears is a tough task, then the Pioneer 25, developed by Spark Racing Technology, made a good start to its mission. It tackled Goodwood's iconic 1.16-mile hillclimb multiple times across four days, demonstrating strong performance and reliability throughout.

"We couldn't have asked for a better first outing," admitted James Taylor, Chief Championship Officer of Extreme H. "The feedback from the public has been overwhelmingly positive, people are genuinely excited about hydrogen's potential in racing.

"It's a huge step forward for Extreme H and a sign of what's to come."

Last month Extreme H also officially joined Hydrogen UK. The UK's leading industry association is championing the scale-up of hydrogen infrastructure and investment throughout the UK.

"Extreme H will be a powerful global platform to prove what hydrogen can do in high-pressure, high-performance environments, pushing the boundaries of technology, building public trust in hydrogen solutions," insisted Ali Russell, Managing Director of Extreme H.

"Collaboration is key to unlocking a resilient hydrogen economy, and we look forward to working with Hydrogen UK's members to help turn ambition into action."

Powered by Symbio Motorsport's 75 kW 'Stack Pack' fuel cell, the category's prototype has already completed the equivalent of three seasons of Extreme E competition. The vehicle's peak 400 kW (550 hp) output is capable of firing the 2,200-kilogram, 2.4-metre-wide race car from 0-100 kph in 4.5 seconds and scaling gradients of up to 130 per cent.

Symbio Motorsport, an official technical partner, is initially likely to supply the fuel cells for every car. However, Extreme H has already had "some good conversations" with OEMs that could be interested in joining the series with their own products.

Following its successful debut, details regarding Extreme H's kick-off event date and location are being finalised and will be made in the coming weeks. RT

34 seconds that changed our view of hydrogen

THE Hindenburg disaster of May 6, 1937, was a turning point in public perception of hydrogen.

The German airship LZ 129 Hindenburg, filled with approximately 200,000 cubic metres of hydrogen, caught fire while attempting to dock at the Lakehurst Naval Air Station in New Jersey. Within 34 seconds, the airship was entirely consumed by flames, resulting in 36 fatalities.

Although the majority of passengers survived, the visual impact – widely publicized through newsreels, photographs, and eyewitness accounts – left an indelible mark on the public consciousness.

Longer than three Boeing 747s placed end-to-end, the airship was only slightly shorter than the Titanic. It was the largest flying machine ever built and remains so to this day.

Hydrogen's flammability became the focal point of post-disaster investigations and media coverage. The exact ignition source is still debated, but potential causes include electrostatic discharge, gas leakage, or even sabotage.

From a technical perspective, the event highlighted the importance of containment, leak prevention and ignition control when working with volatile gases. It also demonstrated how public perception can shape the trajectory of a technology's future development. RT

LEFT Herb Morrison's radio report from the scene, including his famous exclamation "Oh, the humanity!", became a historical document of the crash

Motorsport Valley a £16bn jewel in UK crown

ANEW report has described Motorsport Valley as a "jewel in the crown of UK manufacturing" as the area generates £16bn in turnover.

Grant Thornton UK LLP, in association with The Motorsport Industry Association (MIA), conducted the 2024 Review of UK Motorsport Valley, building on previous studies commissioned by the MIA in 2000 and 2013. It reveals that the UK motorsport and engineering services sector reached a sales turnover of £16 billion in 2023 – increasing from £9 billion in 2012 – and now employs 50,000 people.

The report's other key findings include:

- 89 per cent of UK motorsport businesses generate export revenue, with the USA as the top importer.
- 93 per cent make international business decisions from within the UK, underlining the UK's strategic role.
- 70 per cent of all Formula 1 teams and the Formula One Group's HQ are based in the UK's Motorsport Valley.
- Motorsport businesses spent 14 per cent of turnover on R&D, with 94 per cent maintaining or increasing investment.

The sector is closely aligned with the UK Government's industrial strategy, particularly around skills and employment. The report highlights that 34 per cent of motorsport businesses employ apprentices and have a strong commitment to the recruitment and training of future talent.

Meanwhile, 14 per cent have made acquisitions in the past three years, with 55 per cent of those investments made overseas, reflecting a sector expanding its global reach.

The report concluded that Motorsport Valley is more than a leading business cluster – it has become an international symbol of British engineering excellence. The review underlines the industry's strategic importance to the UK economy and its bright future.

Chris Aylett (Chief Executive, MIA) said: "Following a decade of outstanding growth and global success, the UK's Motorsport Valley high-performance engineering cluster is clearly set for a bright future. Increased exports, consistent R&D investment, the recruitment and retention of world-class talent, new corporate investors, and substantial exposure to an international audience are positioning the UK as the undisputed global hub for motorsport innovation.

"This is not just sport – this is a substantial industry with enormous impact across numerous sectors, including aerospace, defence, marine, and medical.

"The motorsport industry has shown remarkable resilience and growth, it continues to be a world-leading example of a thriving business cluster and a jewel in the crown of UK advanced manufacturing. The enthusiasm of young people for the exciting engineering and technology challenges they enjoy in Formula 1 and in all forms of motorsport, will, if harnessed correctly, be a real asset to the UK's future."

Owen Edwards (Head of Automotive, Business Consulting, Grant Thornton) said: "The UK motorsport industry continues to be a global benchmark for high-performance engineering, innovation, and resilience. Our latest report with the Motorsport Industry Association highlights not only the sector's impressive £16 billion turnover and growing international footprint, but also its critical role in advancing technology, skills, and sustainability across multiple industries. Motorsport Valley is more than a geographic hub, it's a symbol of British excellence, and we're proud to support its continued growth and global leadership." RT

ABOVE The UK motorsport industry showcases the best of UK manufacturing and engineering

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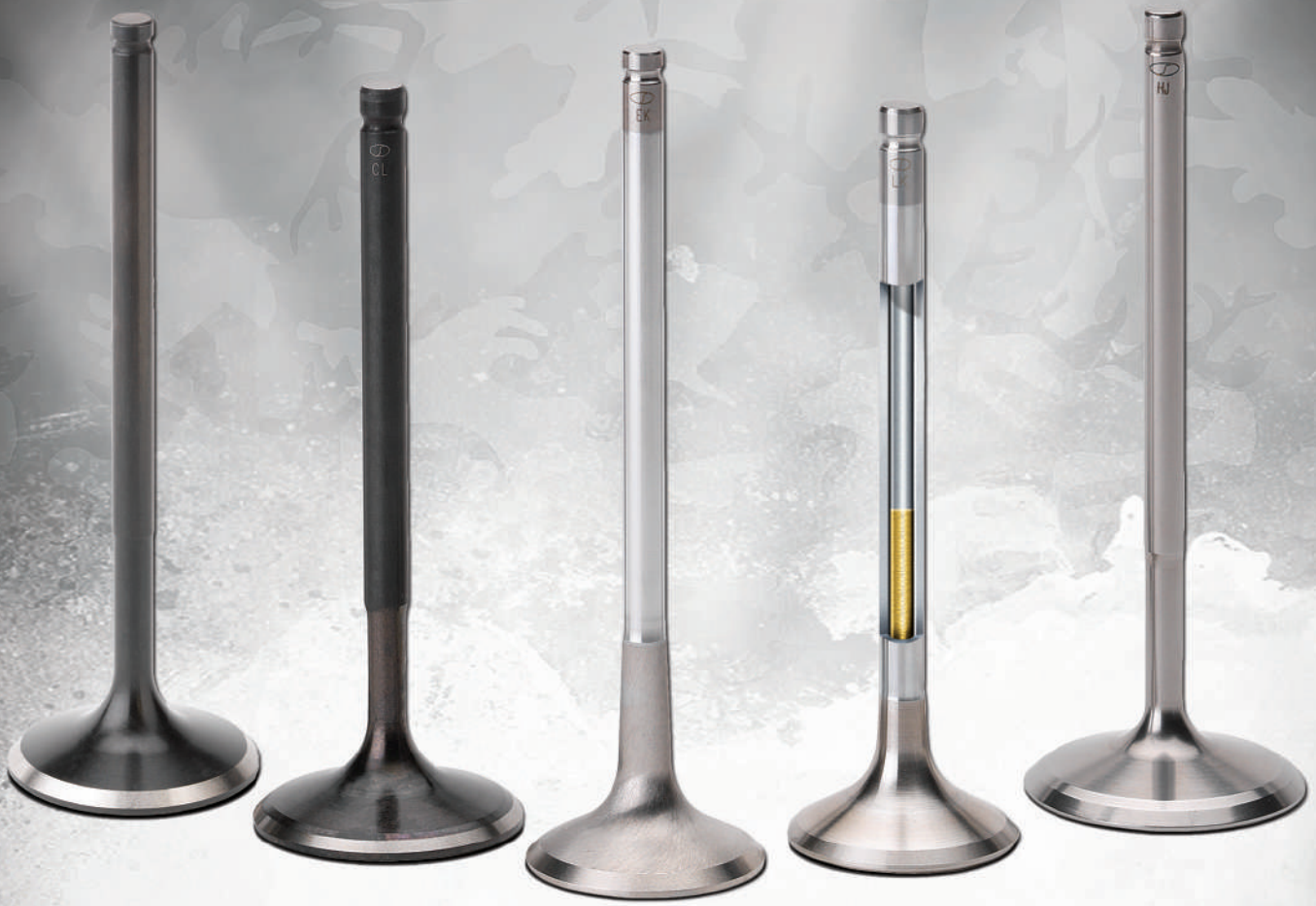

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F1 perplexed by timing of Horner sacking

RED BULL'S sacking of Christian Horner illustrated the fact that sport, for all its entertainment, is still a results business.

"I'm maybe [surprised by] the timing, but not the result," commented McLaren CEO Zak Brown of his rival's mid-season exit. "I think there's been a lot of drama there the last couple of years, and it doesn't seem like that drama has been calming down – maybe been getting worse."

Horner himself admitted in an emotional farewell speech to the workforce at Red Bull's Milton Keynes facility that the axe, when it fell, did come as a "shock".

BELOW Horner's handling of Newey's exit was questioned

"I wanted to stand in front of all of you to break this news, and just express my gratitude to each and every single member of the team that has given so much during the last 20 and a half years that I've been here," he told staff.

"When I arrived 20 years ago, with a few less grey hairs, I walked into a team, I didn't know what to expect. But I was immediately welcomed. And out of two rundown buildings, we started to build what became a powerhouse in Formula 1.

"Watching and being part of this team has been the biggest privilege in my life. Seeing the team..." At this point Horner became emotional and his words were drowned out by applause.

Perhaps the biggest surprise is that the news had come as a shock at all. After all, Horner's position had been under immense threat.

He had survived two investigations following complaints of sexual harassment and coercive behaviour from a female employee. He had also been criticised for his decision to extend Sergio Perez's contract, and for his role in driving superstar designer Adrian Newey to the exit door. He was also engaged in a long-running power struggle with members of the Red Bull hierarchy and had alienated Jos Verstappen, the father of the team's prize asset, Max Verstappen.

Yet for all the mounting problems, Horner had done an incredible job in helping steer Red Bull to eight drivers' titles, six constructors' championships and 124 grands prix wins during his reign. The team's slick and aggressive operation under his guidance leaves him as one of the most successful team bosses in the sport's history.

The irony is that it appeared he had ridden out the storm. For all the external noise, it was ultimately the team's decline in on-track performance – and little evidence that the decline could be reversed – that undid him. RT

Apple challenges ESPN for F1 US rights deal

TECH giant Apple is poised to outbid ESPN for the rights to screen Formula 1 in America.

Emboldened by the success of its new F1 movie starring Brad Pitt, Apple is reported to have submitted a bid worth at least US$150 million per year to broadcast Formula 1 in the US.

That figure is significantly more than current rights holder ESPN pays. However, the Disney-owned broadcaster appears unwilling to get drawn into a bidding war.

US viewership of Formula 1 dropped three per cent in 2024 but in 2025 is recording its most successful season to date.

Apple's film with Brad Pitt is the most successful Apple Original film to date, having grossed over $460 million globally.

It marks a new career high launch for Pitt, exceeding expectations and outperforming other recent major releases. RT

LEFT The success of Apple's F1 movie has inspired its bid to broadcast F1 in the US

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Toyota debuts hydrogen Rally2 car in Finland

TOYOTA has cemented its position as a leader in hydrogen technology in motorsport with the debut of its GR Yaris Rally2 H2 Concept, a hydrogen-engine rally car, on the stages of Rally Finland.

The Japanese manufacturer has been competing with a hydrogen-engine Corolla since 2021 in the Super Taikyu series in Japan. Jari-Matti Latvala, Team Principal of Toyota GAZOO Racing World Rally Team, has been among the drivers who have raced with the innovative powertrain and provided their feedback in its development.

In 2022, the technology was demonstrated on the rally stages of Europe for the first time when the experimental GR Yaris H2 made its debut at the FIA World Rally Championship round in Belgium, driven by Akio Toyoda and Juha Kankkunen.

ABOVE Toyota is in the hydrogen vanguard with the GR Yaris Rally2 H2 Concept

Since then, development has accelerated with a switch from gaseous to liquid hydrogen in the Super Taikyu experiment, mirrored subsequently by the FIA's decision to champion the use of liquid hydrogen in endurance racing. The new Rally2 H2 Concept shares the ICE platform used in Super Taikyu, a three-cylinder 1.6-litre engine, and will leverage the experience gained by the Japanese engineers.

The car demonstrated at Rally Finland is based upon the successful GR Yaris Rally2 chassis and fitted with an internal combustion engine fuelled by compressed hydrogen, delivering near-zero emissions while retaining the sounds and sensations so enjoyed by rally fans.

The GR Yaris Rally2 H2 Concept has been developed at TGR-WRT headquarters in Jyväskylä, Finland, and tested on local roads, including runs on gravel forest roads like those used in Rally Finland. For its public debut, the car was demonstrated on the mixed-surface Harju stage in the centre of Jyväskylä.

It was also exhibited in the service park during the event alongside other hydrogen vehicles like the Toyota Mirai and Tundra, as part of a wider showcase of hydrogen technology across the city of Jyväskylä.

Alpine unveils "gateway to electric competition" with new A290 Rallye

THE FIA's new electric rally category is growing in momentum, with Alpine taking the covers off its new A290 Rallye just weeks after Opel revealed its Mokka GSE Rally.

Designed in line with the latest eRally5 rules, which regulate the motor, battery and inverter used in two-wheel-drive, production-spec models, the A290 Rallye made its dynamic debut at the Goodwood Festival of Speed. The car is claimed to be a genuine gateway to electric competition.

Based on the production A290, the competition version features a welded roll cage and Sabelt bucket seats. The engine's 220 hp and 300 Nm are transmitted to the front axle through a single motor with the help of a ZF limited-slip differential.

Braking is provided at the front by 6-piston monobloc callipers and 350 mm discs. At the rear, single-piston callipers work on 280 mm discs, all with ABS control.

ABOVE A noise emitter addresses one of the complaints made against early rally EVs

Developed by the team at Viry-Châtillon, the A290 Rallye has ALP Racing Suspension shock absorbers, a hydraulic handbrake, and EVO Corse wheels with Michelin Pilot Sport A tyres.

With sound an integral part of the experience for both the public and rally drivers, an innovative new system enables the emission of a sound that correlates with the vehicle's speed and throttle position.

The price of the Alpine A290 Rallye is set at €59,990, excluding VAT, for the complete, assembled, and painted car.

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McLaren Applied rebrands

McLAREN Applied, the technology and engineering solutions division spun out of the McLaren Group, has rebranded as Motion Applied.

The rebranding aims to extend the company's reach and impact beyond traditional motorsport, showcasing its innovative solutions for a more connected and sustainable future.

The change reflects a strategic shift focusing on connected transport and applying Formula 1-derived technology to various industries. The rebrand is said to signify a move towards a more integrated approach.

Previously part of McLaren Group, McLaren Applied became an independent company in 2021, owned by the private investment firm Greybull Capital.

Greybull makes long term investments in private companies and has a broad portfolio across multiple sectors including technology, engineering and manufacturing. Its investment has helped accelerate development of Applied's growth activities across other industries.

Its engine control units and high-performance components remain a core part of Formula 1, IndyCar and NASCAR. However, it increasingly leverages the technical expertise and dynamic mindset of motorsport across other industries.

Its 800V Silicon Carbide inverter, for instance, delivers exceptional powertrain efficiency for faster charging and longer-range electric vehicles.

Its other high-profile breakthrough is a first-of-its-kind 5G edge computing rail antenna developed in partnership with HUBER+SUHNER. The solution considerably improves signal stability, while decreasing cabling weight. RT

BELOW Applied's ECUs feature on every F1 car

Red Bull Content Pool

GPS good enough for trip to shops but not motorsport, insists tech startup

TECH startup Infrared Kinetics (IRK) has unveiled a first-of-its-kind real-time vehicle tracking system that it believes could redefine motorsports, gaming, and beyond.

IRK's breakthrough lies in localised, ultra-precise infrared tracking. The system captures real time vehicle location with <5cm accuracy and 100Hz refresh rates, even in fog, glare, or at speeds nearing 200 mph.

"GPS is good enough for getting to the shops. It's not good enough for motorsport," said Gill Switalski, CEO. "IRK's tech doesn't rely on satellites, it builds a local, high-fidelity infrared environment that delivers precision tracking with near-zero latency. That opens doors."

IRK's British GP showcase for the system featured a real-time demo at its test facility, Mallory Park. Attendees saw IRK's infrared tracking system power live digital twins, enabling: on-demand personalised viewing for fans (choose your camera, driver, or drone shot); live integration into gaming platforms, enabling players to race against real world cars, in real time, inside Assetto Corsa; and new data capabilities for race control, driver training, and safety management.

"This isn't just about better tracking," said Dr Scott Page, CTO. "It's about making motorsport data usable, for fans, teams, regulators, and developers, in a way that's never been possible before."

IRK isn't stopping at racing. The company laid out a modular commercial model that touches: performance and governance (track limits, safety, coaching); fan engagement and broadcast (interactive viewing, digital twin integration); and mass-market gaming (live overlays, VR integration).

IRK is now assembling consortia of early adopters to commercialise its platform across motorsports, broadcast, and gaming sectors. Unlike many startups, it is not seeking capital at this stage, it is looking for operational partners ready to pilot, integrate, and scale.

"We're past theory. The tech works. Now we're looking for stakeholders who want to lead, not follow," said Dr Page. RT

RIGHT Infrared Kinetics unveiled its groundbreaking real-time tracking tech at the British GP

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Fillon: "Hydrogen one of the solutions, not *the* solution"

BELOW MissionH24's H24EVO was a backdrop for the debate

HYDROGEN-powered prototypes will be allowed to participate in endurance racing from 2028, but ACO President Pierre Fillon reminded a conference in Sao Paulo last month that hydrogen "is one of the solutions and not *the* solution".

Fillon was talking during a conference dedicated to hydrogen and the decarbonization of racing.

Talking of decarbonization, Fillon said: "It's the DNA of the 24 Hours of Le Mans and the FIA World Endurance Championship. First, we reduced fuel consumption by almost 50% with hybrids. Today, hydrogen, which is one of the solutions and not *the* solution, allows us to introduce machines with the same autonomy and pit stops, similar to those of conventional combustion engine cars, but with zero CO2 emissions."

"Hydrogen is an interesting solution, it complements all-electric," suggested Bruno Famin, director of competition for Alpine, whose hydrogen combustion-powered Alpenglow Hy6 prototype formed part of the hydrogen demonstrations at this year's Le Mans 24 Hours, lapping at a top speed of 313 km/h.

"The advantage of the combustion engine?" he continued. "It remains a combustion engine with all its sensations, noise, and vibration, but beyond this passion aspect, there is a real technical interest in this engine, which requires a lot of torque and is therefore suited to the demands of a racing car as well as certain utility vehicles for mobility."

The technical challenges for introducing hydrogen to endurance racing extend beyond the engine itself, into the storage and refuelling ecosystem.

Fillon, also Co-President of MissionH24, underscored the reality of the task ahead. "Our mission is to bring hydrogen to competition with mobility applications," he said. "It's about producing green hydrogen, studying the entire production chain, storage, and more. We're living in an extremely exciting time. We're preparing the future for future generations." RT

THE FIA'S HYDROGEN MISSION
Page 24

FIA/ACO/DPPI

ABOVE Fillon: leading the hydrogen push

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WRC fuel bladders upgraded with F1 tech

EVERY car in the World Rally Championship will now feature a crash-resistant fuel bladder made by Aero Tec Laboratories (ATL), using DuPont's Kevlar EXO wonder material.

Introduced from WRC Delfi Rally Estonia, this upgraded fuel bladder reduces the overall weight of the Safety Fuel Cell by around 20%, increasing performance while prioritizing safety, fuel compatibility and efficiency.

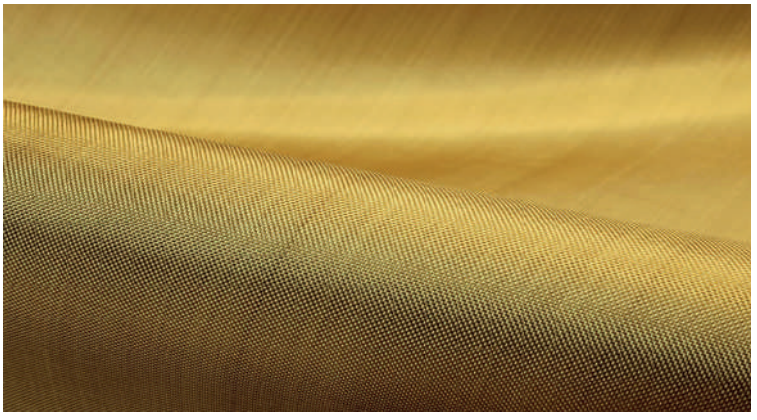
This marks the next step in DuPont and ATL's partnership to bring innovation to the racing industry. In October 2024, the two companies announced the launch of the crash-resistant fuel bladders in Formula 1 as they completed testing to meet the stringent FIA safety requirements.

"Being able to apply our learnings beyond F1 moves us toward reaching our shared goal to further innovate equipment in the racing industry," said Jill Clements, DuPont Segment Leader.

Kevlar EXO is DuPont's biggest aramid fibre innovation in over 50 years. While first introduced to the life protection market in April 2023, its exceptional balance of flexibility and lightweight strength has led to a number of discoveries and innovative applications including its use for orbital debris protection in satellites and in improving the comfortability of bullet-resistant vests.

"Behind the scenes, DuPont and ATL have worked tirelessly to overcome the challenges presented by the introduction of new sustainable fuels in the extreme conditions presented by the World Rally Championship, with a focus on safety and the efficiency of these amazing machines," said ATL CEO Giles Dawson. "By integrating Kevlar EXO into these reimagined fuel bladders, we're not just reducing weight – we're helping teams gain a competitive edge while increasing protection and reliability."

The technology is likely to filter across to other motorsport series such as NASCAR, IndyCar and Le Mans. RT



BELOW The use of Kevlar EXO has been rolled out to the WRC

TOCA 'unlocks' next five-year cycle of NGTC regs

TOCA – organiser of the British Touring Car Championship – has introduced more freedom within the next five-year cycle of its NGTC technical regulations, commencing 2027. The changes are aimed at reducing costs and promoting greater parity among competitors.

The NGTC rules are now in their 15th season, with another year left of the existing specifications. The goal of the new regulation cycle is to protect the assets of teams by maintaining eligibility for existing machinery, whilst introducing additional car and engine options.

TOCA has unlocked the necessity for the specific model of the car to be sold in the UK. Providing that the vehicle brand is sold within the UK, then any ICE model from that brand can be entered.

Furthermore, it has also unlinked the engine requirements to each respective car, meaning that any BTCC-homologated engine can be used – not necessarily that from the original manufacturer of that specific car.

Registered BTCC engine builders will also be bound to supply its engine to any interested team(s) if requested, although no engine supplier can provide more than 50% of the entered cars – with the exception of M-Sport's TOCA engine, which is available to all teams.

Alan Gow, BTCC Chief Executive, said: "Every team wanted the BTCC to continue with the evolution of our great technical regulations... that was unquestioned. Therefore, our current stakeholders now have the assurance that their major components and capital investment will remain valid through 2031.

"This evolution of the regulations also provides teams with more options, through opening the door to a host of new models and engines. The BTCC technical regulations, like the BTCC itself, is a true British success story." RT

Ebrey/BTCC

LEFT The super-successful NGTC rules have been opened up

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F1's low carbon energy rollout changes gear

RIGHT The initiative significantly reduces the number of individual generators on-site

FORMULA 1'S drive to achieve Net Zero Carbon by 2030 has quickened pace with the rollout of Aggreko's low-carbon power solutions to all the European races.

With the cars themselves responsible for only 0.7% of F1's carbon footprint, the seven-year partnership with Aggreko – its Official Temporary Power Solutions Provider – is playing an increasing role in tackling energy efficiency within the paddock.

Aggreko is providing low emission solutions through its Greener Upgrades range, which includes solar PV hybrid systems using Battery Energy Storage Systems (BESS) and Stage V generators fuelled with hydrotreated vegetable oil (HVO).

The success of this approach has already been demonstrated when a centralised energy solution was used at three races last year, including the Austrian GP. The solar PV, hybridised BESS and HVO-fuelled Stage V generator solution reduced the need for at least 30+ additional generators from other suppliers and reduced associated carbon emissions by >90% compared to the 2022 event. Similar results are expected in 2025.

Aggreko provides real-time telemetry and monitoring systems for the races, enabling rapid response times and chelping the collection of valuable data on energy usage, emissions, and renewable energy. Data collected from last year's trial is being used to optimise solutions for future races and contributes to Aggreko's wider gathering of insights from its global fleet to deliver the best performance to industries worldwide.

Ellen Jones, Head of ESG at Formula 1, said: "The delivery of our Net Zero by 2030 commitment is driven by new technologies and new ways of working. With Aggreko's support, Formula 1 is taking another step to reduce emissions across the paddock."

Robert Wells, Europe President and Head of Events at Aggreko, said: "Our partnership with Formula 1 is built on the strength of our shared vision and values. By improving performance in innovation, sustainability and technology through our work powering some of the sport's supporting infrastructure, we are showcasing how bespoke solutions using our latest technologies can help meet ESG goals in a setting that is the ultimate test of performance.

"We're proud to collaborate with Formula 1 on its global stage, setting a shining example of how large event operators can accelerate change by learning from this progressive approach in reducing emissions." RT

DHL to power FIA race logistics

THE Fédération Internationale de l'Automobile (FIA) has announced a comprehensive partnership with DHL, the world's leading logistics company.

As Global Logistics Partner, DHL will manage the transport, installation and maintenance of key FIA infrastructure across the Formula 1, Formula 2 and Formula 3 championships. This includes FIA trackside infrastructure such as mobile office units and garages as well as race-critical equipment.

Sustainability is a central pillar of the partnership. As part of the agreement, DHL will deploy seven trucks for European logistics, each powered by hydrotreated vegetable oil (HVO) which cut emissions by up to 83% compared to conventional fuels.

DHL will support the sport to deliver the rationalised calendar that has been developed to create a geographical flow of races, thereby reducing travel distances across the season and enabling the use of lower-carbon freight solutions. These efforts contribute directly to the FIA's ambition to halve its carbon footprint by 2030 compared to its 2019 baseline.

FIA Chief Commercial Officer, Craig Edmondson, said: "This partnership with DHL is a great opportunity to collaborate not only on the vital behind-the-scenes work that goes on at any track event, but also to drive sustainable practices across our industry. Pushing for greater sustainability across both motorsport and mobility is a priority for the FIA, and we are constantly seeking to embed this ethos into our ways of working." RT

LEFT The DHL partnership marks a new pillar of the FIA's 2030 carbon reduction strategy

Bcomp launches "next step" for natural fibres

SWISS lightweighting specialist Bcomp has launched what it terms 'the next evolution of natural fibre composites in motorsport' at the 2025 Nürburgring 24 Hours.

The Four Motors Porsche GT3 Cup car used exterior body components produced with Bcomp's grey ampliTex, highlighting a new and innovative aesthetic for one of the world's leading high-performance natural fibre composite materials.

Ken Kruck, Sales Representative Motorsports at Bcomp, said: "These new processes allow us to deliver a new look for natural fibre composites, that is not only high-performing, but also road relevant. Following the success of coloured ampliTex in road car interiors, we are proud to bring this Bcomp grey as our signature motorsport colour to race cars."

The grey tone of the parts showcases how natural materials can be tailored beyond the natural gold-brown appearance of flax-fibres seen in earlier models. Road relevance is further reinforced by painted surface on the exterior parts, rather than the foil typically used in race components. While adhesive films (foils) are used to allow for rapid design changes, the use of paint further demonstrates the feasibility of natural fibre composites in high-performance road cars.

The hood, rear wing end plates and front bumper diveplanes of this year's Four Motors Porsche GT3 Cup car have been reverse engineered by Bcomp. Previously made from aluminium and carbon fibre for the production racecar, these parts were manufactured using Bcomp's coloured ampliTex flax fibre reinforcement fabrics. When produced in an autoclave in combination with Bcomp's powerRibs, natural fibre parts can achieve an equivalent stiffness and weight to carbon-fibre components.

Matthias Scholz, Director GT Racecars at Porsche Motorsport, commented: "The implemented components of the Four Motors Porsche GT3 Cup car were created in collaboration with Bcomp and Porsche Motorsport to demonstrate the next step in the material development of natural fibre components. These findings will be incorporated into future products."

BELOW The Four Motors Porsche showcased a new aesthetic

Audi opens UK Technology Centre

AUDI addressed one of the potential weak points of its 2026 F1 assault last month by opening a UK base that will let it tap into the rich seam of talent in the UK's 'Motorsport Valley'.

Sauber Motorsport announced the opening of its new Technology Centre, at Bicester Motion, as the next step in its transformation into the works Audi team.

The facility's primary purpose is to ensure the team is well-positioned to attract top engineering talent and foster partnerships with leading industry supply chain specialists in a region where seven of F1's 10 teams are based.

The Bicester centre in Building 123 will provide a base for the team to benefit from the expertise within the area and support the Audi F1 Project's HQ in Hinwil, Switzerland.

Mattia Binotto, Head of Audi F1 Project, called the move a "significant milestone".

"This facility will allow us to tap into the talent pool in Motorsport Valley and further strengthen our technical capabilities while being part of a thriving cluster at Bicester Motion where you live and breathe motorsport," he said. "The support it will play to Hinwil will be important to our long-term success."

Daniel Geoghegan, Chief Executive Officer, Bicester Motion, commented: "It is thrilling that Bicester Motion has been chosen as their UK base connecting into their Swiss and German operations to support their vision to deliver sustainability, innovation, and maximum performance in motorsport.

"They join many other pioneering automotive and aviation companies, along with Motorsport UK, already based here. We look forward to seeing their team develop and their transformation on and off the track continue."

LEFT The base at Bicester Motion will support the engineers at Hinwil and Neuburg

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"The WMS has become a yearly 'Must Attend' event. The now-usual presence of many motorsport leaders, and especially of the governing bodies, make the discussions go beyond just interest: they can really influence the future of our sport. It is now more important than ever to call upon the brightest minds there to design a path toward the necessary energy transition. Long life to the WMS!"

LIQUID ASSETS

Chris Pickering speaks to key players from the FIA about their latest plans for ensuring hydrogen becomes a viable part of motorsport's future

FOR more than a decade, hydrogen has been touted as the future of sustainable motorsport. At times, though, it has felt like a mirage; for every step forward taken in hydrogen technology, the goal of bringing it to mainstream motorsport appears to have taken a corresponding step back.

But could the last major obstacle finally be coming down?

The key challenge around hydrogen has always been storage. With gas tanks, it's the sheer amount of space they take up in the car – the volumetric energy and density of hydrogen in this form is less than a fifth of petrol's, which means it would be practically impossible to match the speed and range of conventional cars.

With liquid hydrogen, that problem is largely solved (its volumetric energy density still lags behind conventional fuels, but it is close enough to work). It also has the advantage that it bypasses some of the safety concerns attached to carrying high-pressure gas tanks around in a 200mph projectile.

Julien Delfosse/DPPI

However, liquid hydrogen is truly a leap into the unknown. Stored at around -253 deg C and principally used in space exploration as rocket fuel, it's an otherworldly material that requires specialist knowledge and careful handling. Even storing it off the car is problematic as any heat soak from the outside world will result in a percentage of the precious liquid boiling off and potentially pressurising its container.

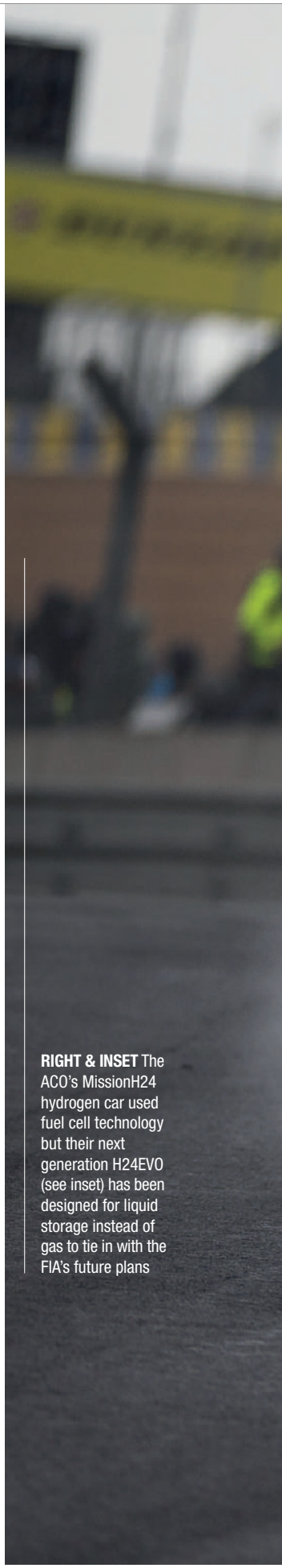
None of the challenges around liquid hydrogen are insurmountable. Toyota has demonstrated this with the GR Corolla that recently contested the Fuji 24 Hours for the third year in a row. Others – Alpine and Ligier among them – have talked publicly about their interest in converting their own hydrogen projects to liquid storage, but have yet to take the plunge.

Part of the problem is that there has been little common framework for these hydrogen projects to work around so far. Each has had to start from scratch, solving a barrage of problems along the way. Now, however, the FIA has approved its first ever set of safety standards for the use of liquid hydrogen in motorsport. These cover factors such as refuelling procedures, tank design, leak detection systems and methods to deal with boil off.

"The main focus of these regulations is the liquid hydrogen storage and how we integrate that into the car," explains the FIA's head of R&D, Nicolas Aubourg. "For instance, the level of insulation you need to have and the system you need to use to manage the pressure. Most of what we have released so far is around the tanks. We are now also working on the coupling [to the refuelling rig] and the hydrogen pump."

Universal standards

The standards are universal, as Xavier Mestelan Pinon, the FIA's chief technical and safety officer, ▶



RIGHT & INSET The ACO's MissionH24 hydrogen car used fuel cell technology but their next generation H24EVO (see inset) has been designed for liquid storage instead of gas to tie in with the FIA's future plans

Javier Jimenez/DPPI

Toyota GAZOO Racing

Toyota GAZOO Racing

LEFT & FAR LEFT Toyota already competes in the Japanese Super Taikyu series with the hydrogen-engine Corolla – initially using gaseous hydrogen before introducing a liquid hydrogen-powered car from 2023

explains: "A year and a half ago the World Motor Sport Council took the decision to promote and develop liquid storage rather than gaseous storage – mainly in terms of the size and weight of the storage system, but also due to the safety aspect, because high-pressure gas could raise all sorts of concerns.

"In June, we submitted the first regulations to the World Motor Sport Council. These are generic regulations that could potentially be adapted to any of the FIA championships in the future. It could be the World Endurance Championship, but it could also be

> *"The key challenge around hydrogen has always been storage"*

Toyota GAZOO Racing

Formula 1 or truck racing."

All three have been linked to hydrogen at some stage. Formula 1's former technical director Pat Symonds predicted in 2020 that the next generation of F1 powertrains could be the last to be powered by petrol. Truck Racing could be particularly relevant, with road-going trucks heavily tipped to adopt liquid hydrogen technology (something which seems unlikely for mainstream passenger cars). But the World Endurance Championship is likely to be the key focus – at least for now. The ACO is still championing plans for a hydrogen category as soon as 2028 and yet no regulations have so far been published.

Realistically, no manufacturer will commit to the series until a draft set of technical regulations can

LEFT Liquid hydrogen operates at lower pressures than gaseous hydrogen so there is more flexibility over tanks. The Corolla hydrogen tank's custom elliptical shape (left) means it can hold 15kg of hydrogen, while the old one (right) holds just 10kg

RIGHT Toyota GAZOO Racing has unveiled the GR LH2 Racing Concept to advance the development of liquid hydrogen technology in motorsport

be produced, no matter how keen they might be to support the idea in theory. By releasing these safety standards, the FIA has laid the foundations for a full set of hydrogen technical regulations, which would allow prospective manufacturers to gauge exactly what they're letting themselves in for – perhaps providing the context they need to sign on the dotted line.

The plan, Aubourg explains, is that experts on each championship will be brought in to fine tune the generic hydrogen safety regulations for their specific application. They will look at series-specific questions like how to package the required volume of hydrogen within their vehicle architecture.

"The biggest challenge from a performance perspective is taking a similar chassis concept to those we have used so far and adapting that for a storage system that's potentially bigger in terms of volume," he explains. "The advantage we have in motorsport is that we will fill the car up and then use the fuel almost straight away [so there is not much time for boil off to occur]. This means we can explore how to optimise the storage system without features like vacuum jackets [which you might use on a road car where you need to store the hydrogen for a week]. We're also trying to decrease the size and weight of the pumps.

"Since switching to liquid storage, we've seen the weight come down every ▶

Toyota GAZOO Racing

Julien Delfosse/DPPI

time we've spoken to manufacturers and suppliers. Everybody is converging on a new working point and it's evolving quite quickly. We think this technology could perform very well in the next few years, with a light car using a conventional architecture that looks like a Formula 1 car or a hypercar."

To boldly go

Marco Petrilli, the FIA's deputy safety director and head of research and vehicle safety says the depth of research that has gone into the new regulations is unprecedented: "We are very data-driven at the FIA. We're used to working with external stakeholders, including the OEMs and the energy source experts, to leverage their expertise. But, when it comes to liquid hydrogen, it's still an embryonic technology – on the road as well as the track – so that expertise isn't really out there yet. The amount of research that has gone into the project from our side has been higher than any other technology that we've faced in the past, with the financial support of the FIA Foundation playing a fundamental role."

There's growing interest around liquid hydrogen in heavy duty automotive, with Daimler Truck and Chinese manufacturer FAW both now carrying out real-world tests, but the technology remains very much in its infancy. Its main application remains rocket propulsion, so the FIA worked extensively with French aerospace specialist ArianeGroup as well as other companies in the defence and marine industries.

It was a steep learning curve for all involved. Petrilli says the FIA's technical department was essentially starting from scratch.

"There are some parallels to the way that we have faced other new technologies like high voltage electrical systems, but hydrogen poses some unique challenges," he says. "Petrol is stable under atmospheric conditions. You don't need to heat it up or add pressure. The same is basically true with a high voltage battery. But when it comes to hydrogen – in gas or liquid form – you need to transform it by managing the temperature and pressure.

"What we're doing now is carrying out a bespoke motorsport risk assessment to really understand what safety devices need to be implemented in the tank. How do you prevent, say, the tank bursting if the pressure gets too high? How does that affect the way that the car is designed?"

While much of the focus is on protecting the fuel tanks and the associated hardware to eliminate problems before they occur, the FIA has also had to consider what happens if things go wrong. One issue is that hydrogen, much like methanol, burns with a very faint flame that's virtually invisible in daylight. Consequently, marshals and track safety crews will need to be equipped with special goggles, similar to those which were used in IndyCar during its methanol era. ▶

ABOVE Alpine is one of the companies throwing its resources into hydrogen with its Alpenglow Hy6 running on a 3.5-litre V6 engine

BELOW The Alpenglow Hy6 runs on gaseous hydrogen but the company is looking at feasibility studies for liquid for its next iteration

Julien Delfosse/DPPI

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Different applications

Mestelan Pinon stresses that the FIA is not focusing its efforts solely on hydrogen, but making space for it in a technology portfolio that will also include battery electric powertrains, hybrids and other sustainable energy carriers.

"We need solutions that work for a wide range of championships, from Formula 1 to grassroots. For instance, as things stand currently, EV powertrains would make no sense for endurance racing, but hydrogen could be a solution. We try to find the best available technology for each championship," he comments.

There are, of course, multiple technologies even within the hydrogen world. After the initial flurry of interest around fuel cells, hydrogen combustion now seems to be attracting greater interest in motorsport. It could be argued that fuel cells, with their silent electric propulsion systems and zero NOx emissions, make the bigger statement from a technological and environmental perspective. Currently, they also have a stronger link to road-going hydrogen vehicles like the Toyota Mirai and the Hyundai Nexo. But as with early adopters on the road, it's debatable how many fans want something fundamentally different; it's possible that the familiarly visceral appeal of a combustion engine may prove more popular.

The FIA is remaining agnostic on this point, with the regulations designed to cover both fuel cell and combustion engine installations. In terms of hydrogen handling and safety, it actually makes very little difference, Petrilli points out.

"With a fuel cell vehicle, you have a second part to consider, which is the high voltage electric system. However, that's very similar to the technology on electric and hybrid cars that we have already, so it doesn't make too much difference," he comments.

"We can split the car into a set of safety boxes. So, you might have a set of specifications for the chassis, a set of specifications for the fuel cell and so on. What we have so far are the specifications relating to the hydrogen

BELOW This year Opel has launched the first car built to the FIA's new eRally5 regulations, the Mokka GSE Rally

BOTTOM Could the World Rally Championship be next in line for the hydrogen revolution? The aim is to make it attractive to manufacturers

Opel Automobile GmbH

Jaanus Ree/Red Bull Content Pool

Julien Delfosse/DPPI

RIGHT The FIA's chief technical and safety officer Xavier Mestelan Pinon is keen to spread the hydrogen revolution in global motorsport

storage system. That's the most important bit, as we are already very comfortable with high voltage electrics and combustion engines – whichever route is used to generate power from the hydrogen."

Filling the gap

The FIA is already working with the ACO on a set of regulations for hydrogen cars in the WEC. Alongside safety, there is the task of writing a framework that will allow the hydrogen cars to compete against conventionally-powered opposition – or at least share the track without getting in each other's way.

Another performance aspect to consider is refuelling. One of the benefits of using liquid hydrogen is that it is not as sensitive to the pressure changes that can make refuelling a high-pressure gas cylinder a tricky process to manage. Even with the smaller mass of hydrogen contained within gas tanks, it would be hard to refuel in anything less than a minute. By using liquid fuel, Aubourg says the FIA is targeting a refuel rate of 1kg per second. This would theoretically allow the required mass of hydrogen to be filled in around 20 seconds, although he says it's likely that they would start with a slower rate – perhaps half a kilo per second – and work towards that target.

"It's one of the performance aspects of liquid hydrogen that simply isn't reachable with compressed gas," he notes.

Nevertheless refuelling also needs a short period before and after putting the liquid hydrogen into the car: the connection and disconnection must be made following a specific protocol (communication from the car to the refuelling station, sanitisation and valve openings) which can take a few additional seconds.

The million-dollar question remains, when will we see these cars on track? Mestelan Pinon admits it's still hard to give a precise date, but he's optimistic that we will see something before the end of the decade: "We are thinking something like 2030 [for a fully-fledged hydrogen category] but maybe we will see Garage 56 entries before that. Manufacturers like Toyota and Alpine are very involved with hydrogen already, but there are still a lot of unknown factors."

Meanwhile, the FIA is looking at how alternative powertrain technologies could be integrated into other categories. The 2027 World Rally Championship (WRC) technical regulations, released last month, tantalisingly state that the next generation of top generation rally cars will be allowed to use alternative powertrain technologies. Although it's perhaps a little early at this stage, the regulations' planned 10-year lifecycle could well see hydrogen and other options reach maturity.

Alternative powertrains are certainly a hot topic in rallying. Earlier this year, Opel launched the first car built to the FIA's new eRally5 regulations, the Mokka GSE Rally. More recently, Toyota unveiled the GR Yaris Rally2 H2 Concept. Based on Toyota's GR Yaris Rally2 chassis, it's a working prototype fitted with an internal combustion engine allied to compressed gas storage.

> *"By using liquid fuel, the FIA is targeting a refuel rate of 1kg per second"*

Mestelan Pinon says the potential is there to embrace these new technologies in the WRC: "We believe that hybrid, full electric or hydrogen technology could be adapted to the WRC without any massive challenges. We might need to change the event format slightly – especially if we went to full EV – but a stage of 30 or 35km is not an issue if you can recharge afterwards.

"We believe hydrogen could be suitable for the WRC as well. The main question isn't whether or not it would work, but whether it's something that's attractive to manufacturers and fans. Today we have about a dozen manufacturers in the WEC, but it's more difficult in the WRC. We need to work with the OEMs, promoters and the other stakeholders to understand if it's a good route to go down, because of course new technology will impose more cost."

In some respects, the relatively short stage distances in rallying, combined with the tubular spaceframe architecture of Rally 1 cars and the generous packaging envelope provided by their production-derived silhouettes would simplify the task of accommodating a hydrogen powertrain. On the other hand, the challenges of operating beyond the confines of a purpose-built circuit would add complexity to the safety side, as well as the logistics.

"Running in a closed road application is completely different to a circuit," comments Petrilli. "The first issue is that the car is far more likely to impact something that is not designed to absorb energy, like a tree. The car needs to be designed with those risks in mind. Secondly, on a circuit we have marshalling posts distributed along the circuit, so the time it takes to reach the car after an accident is quite short. In a closed road event, it can take a lot longer for help to arrive. So, if the technology can be moved from prototypes and single seaters to rally cars, it's clear that there are some elements that would need to be considered on top of what we need to do in a circuit environment."

So, once again, hydrogen appears to be prompting new questions as well as answers. However, with liquid storage beginning to look like a practical proposition, and a set of safety regulations now governing its application in motorsport, it feels like the momentum behind this technology is finally starting to build. Perhaps it won't be long before the mirage gives way to something solid. RT

RAGING BULL'S BACK ON TRACK

Gary Watkins investigates Lamborghini's all-new beast that's preparing to take over from the Huracan in the world of GT and endurance racing: the Temerario GT3

LAMBORGHINI has built more than 200 Huracan GT3 race cars in all its iterations and won nearly 100 championships since 2015. So the bar had been set high when it came to designing a successor to the first factory-developed GT3 racer from the Raging Bull. But it believes that the new Temerario will be a step forward on the machine that claimed its crowning achievement with a first victory for the marque at the Spa 24 Hours in June. It was a triumph that came a matter of days before the latest car was unveiled at the Goodwood Festival of Speed in July.

The Temerario GT3, which will go into competition with select customers in 2026, represents both an update on the 11-season-old Huracan and an attempt to address its weaknesses. The GT3 landscape is ever changing as the machinery becomes more sophisticated, the category freed up by subtle rule revisions for 2022, and Lamborghini acknowledges that it had to react. But it also identified key areas in which it wanted to improve the product as it strives to continue the successes of the original Huracan and the evolution versions that followed, the EVO and the EVO2 introduced in 2019 and 2023 respectively.

The origins

Lamborghini is billing the Temerario GT3 as the first race car "to be entirely designed, developed and built at the Sant'Agata Bolognese factory in Italy". That's a reference to the co-development of both road and race Huracans alongside

Volkswagen group sister marque Audi's second generation R8. This time there is no R8 road car, at least for the moment. The success, and for that read profitability, of the Italian manufacturer paved the way for it to receive clearance from its paymasters in Germany to develop a road-going successor to the Huracan off its own bat at Sant'Agata near Bologna.

It wouldn't be quite right to say that the GT3 followed on in the workshops of Lamborghini Squadra Corse, the in-house motorsport organisation established in 2013 ahead of the launch of the first Huracan racers, from the original GT3 and the closely-related Super Trofeo one-make racer. Lamborghini has made much of road and race cars being developed in tandem, a mantra also trumpeted by Ferrari on the unveiling of its 296 GT3 three years ago.

The Temerario, says the company, was "conceived from the outset with a motorsport derivative in mind". That has "allowed for strategic integration of racing-oriented engineering from the earliest design stages". Or as Rouven Mohr, Lamborghini's chief technology officer, says: "It was clear from the beginning that the road car would have a brother or sister that would go racing."

The result is the Temerario, the third distinct generation of the Lambo GT3 racer. The Huracan ▶

> *"Lamborghini has made much of road and race cars being developed in tandem"*

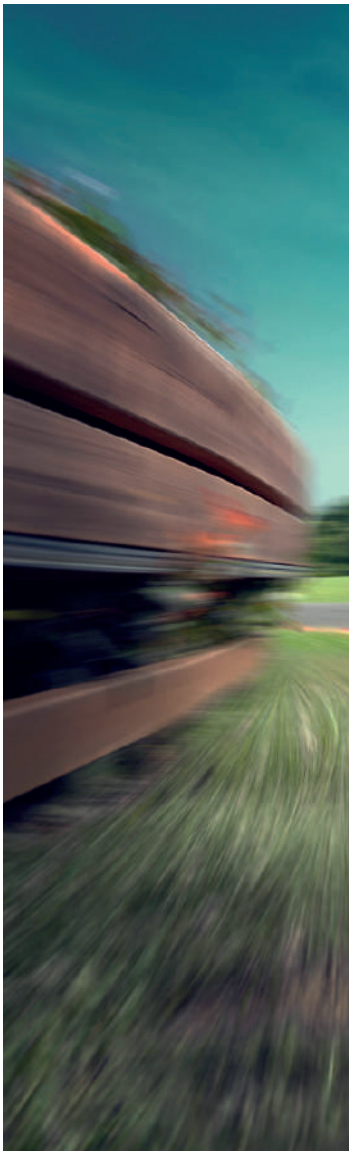
ABOVE The Temerario GT3 was the first race car to be entirely designed, developed and built at Lamborghini's Sant'Agata Bolognese factory

All images: Lamborghini

LEFT & BELOW LEFT Lamborghini unveiled the Temerario GT3 in front of the crowds at the 2025 Goodwood Festival of Speed while the road car (below) took on the famous hill

RIGHT The six-way adjustable KW V7 Racing dampers are making their debut in the Lamborghini Temerario GT3

BELOW Whereas the Huracan had a longitudinal gearbox, the Temerario has a transverse unit – a change made in the name of rear-end aerodynamic efficiency



might have been the first 'official' GT3 car from the marque, but Lamborghini had been a player in the category from its establishment as the FIA GT3 European Championship in 2006. The German Reiter Engineering organisation followed up on the development of a line of GT1 racers – first a Diablo and then a Murcielago – with the Gallardo GT3.

What Stéphane Ratel, the architect of the category, likes to call special tuners, were at the time allowed to develop and, crucially, homologate cars independently of their manufacturer: the first Ferrari GT3s were developed by the Swiss Kessel Racing operation before the factory took over the baton with the 458 Italia GT3 in 2011. Reiter had the support of Lamborghini, which might be best described as tacit in the initial years of a project that spanned multiple versions of the Gallardo: initially Reiter had to buy complete cars to convert into GT3 racers.

Hurricane force

Lamborghini set out to build on the strengths of the Huracan, a car whose credits include two overall titles in the Blancpain GT Series (now the GT World Challenge Europe), a hat-trick of class victories at the Daytona 24 Hours in 2018-20 and a championship triumph in the DTM. What Mohr calls "the basic

concept of the car" remains "quite similar to what we have at the moment with the Huracan". The Temerario, like the car it succeeds, is built around an aluminium spaceframe chassis, though the torsional stiffness has been increased. The Temerario's chassis has 50 percent fewer components than the Huracan's. The new car is also both longer in wheelbase and wider in track, front and rear.

As well as lightweighting of the main structure before the integration of the rollcage, the front and rear subframes have been modified and simplified. This is because road and race Temerarios differ in one key respect. The car for the road is a four-wheel-drive plug-in hybrid with three Motor Generator Units: two at the front and one at the rear. The racer, in line with GT3 rules, is non-hybrid and rear-wheel-drive. All the hybrid components have been removed and race-specific components introduced.

The Temerario, which takes its name from a fighting bull of the late 19th century and roughly translates as courageous or daredevil, is clearly a Lamborghini. The aerodynamics of the race car are being developed jointly by Squadra Corse and Lamborghini Centro Stile. That's present tense, because the car as it appeared at Goodwood is not the finished article. "Not the final, final one," says Mohr, alluding to the fact that the car had only just started testing and is therefore someway off the FIA homologation that will fix the aero configuration.

Mohr, who last year dovetailed his CTO role with heading up Squadra Corse prior to Maurizio Leschiutta's arrival as its new boss early this year, admits that it doesn't look "super aggressive". With a modern ▶

GT3 car, he insists, "the magic is in the underbody".

This is one area where Lamborghini is striving to move forward on the Huracan, working in the wind tunnel at Sauber Technologies (which, like the Formula 1 team, is owned and controlled by Audi). It is aiming, explains Mohr, to have a more "stable, robust underbody" and aerodynamics.

"In the right window, the Huracan is still super competitive," he explains. "With our current car, if it's not in the perfect window regarding ride height, splitter configuration, etc, you lose the peak of performance. So the robustness and the adjustability of the Temerario is, for sure, an improvement."

Mohr references the multi-part front end on the Huracan, which is put together "like a road car". He explains that "there are a lot of single parts and, for instance, with the front splitter you really have to manage the different adjustment opportunities."

The Temerario has single-piece front and rear ends, like the 296 developed down the road by the Prancing Horse, to help achieve that robust aero platform. But the modular nature of the car also represents a major advance in the serviceability of the new car. This was one area where Squadra Corse was able to work with the road car engineers during the concept phase.

"We already considered what would be the right interface to have these exchange and repair possibilities," explains Mohr. "We have the front end you can remove, the rear end you can remove, more-or-less what you know from other GT3 cars that have been presented in the last three or four years. In this context, the development of the competition and the professionalism of the cars is not comparable any more from 10 years ago when the Huracan was born. We have closed the gap to the competitors; we now have the latest state-of-the-art repair options."

ABOVE The Temerario's chassis is both longer in wheelbase than the Huracan and wider in track, albeit with 50 percent fewer components

Designed to be driven

Usability is key in the development of the Temerario. It is being developed with "the end user in mind". Part of the drive towards that goal has involved a move from four-way adjustable dampers to a six-way set-up sourced from KW Automotive in Germany, with which Lamborghini is also working on its SC63 LMDh prototype racing this year in the IMSA SportsCar Championship enduros in North America. It follows the lead set by the opposition and is one that has partially been motivated by a desire to create a more driveable car for the amateur racer. The aim is to end up with a more benign handling machine.

Cockpit ergonomics have been another focus. That includes improved visibility out of the car, which Mohr describes as "a step from the Huracan road car to the Temerario road car". There is also a new steering wheel developed at Lamborghini after consultation with its customers. He concedes that through the multiple evolutions of the Huracan racer "we had added content and if you do that it is not optimal in terms of the ergonomics." Cockpit cooling has also been improved.

> *"Mohr has called the new four-litre V8 unit the most racey turbo engine in the world"*

A partner in the development of the new GT3 racer is Podium Advanced Technologies, the organisation from northern Italy best known for developing and then running the Glickenhaus 007 Le Mans Hypercar in the World Endurance Championship in 2021-23. All Lamborghini will say is that it "supported" Squadra Corse in developing the chassis and the

Newspress

aerodynamics, fulfilling the role undertaken by Dallara Automobili on the Huracan and its evolutions.

A key supplier of bodywork components is again HP Composites, part of the Nicolet family's Everspeed group. Everspeed's umbrella reached over Ligier Automotive, Lamborghini's chassis partner on the LMDh project.

The Powertrain

The Temerario is not the first Lamborghini to be powered by a turbocharged engine. That accolade was taken by the Urus SUV introduced at the end of 2017, but it is the first turbo sportscar – for the road, that is, so not counting the SC63 prototype. A twin-turbocharged engine is increasingly the powerplant of choice for the modern supercar, but Lamborghini set out to do something a bit different. Mohr has called the new four-litre V8 unit developed in-house at Lamborghini as "the most racey turbo engine in the world". Not only is it a flat-plane crank unit, a result of the close eye Lamborghini kept on future motorsport applications for Temerario during the concept phase of development, but it has a 10,000rpm redline.

The crossover to the race car is "one-to-one", says Mohr, as it was with the Huracan and its 5.2-litre normally-aspirated V10. That means the block, pistons, conrods and camshaft. But the requirements of GT3 have resulted in one key difference in the V8 found in road and race Temerarios.

The V8 in the road car produces 800bhp of the total 900bhp output pushed out by its hybrid powertrain. For GT3 only 550bhp or so is required, depending on the Balance of Performance. That has resulted in the reduction of the size of the turbochargers.

"Firstly, it is not needed and secondly without electrification it is not working," explains Mohr of the larger turbos on the road car. He adds that the rev-limit has also been reduced: "It doesn't make sense that the race engine is revving up to 10,000rpm because we don't need all this power."

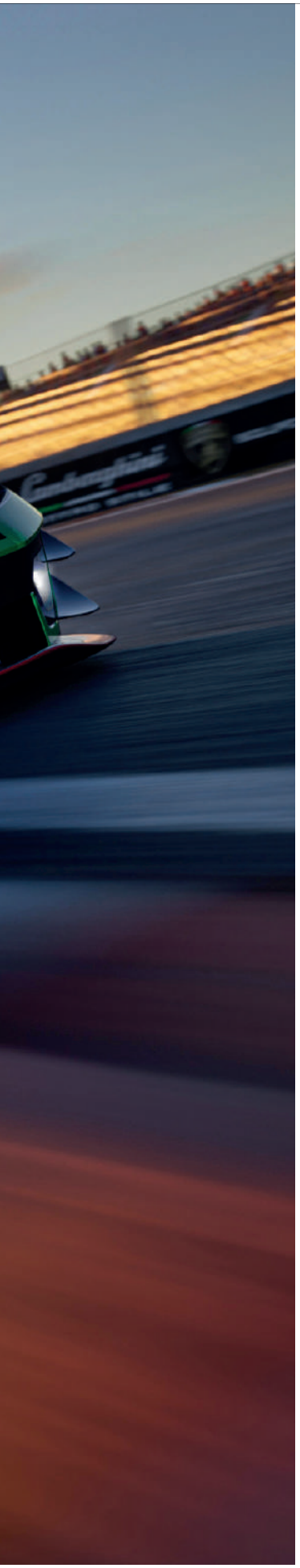
The absence of the hybrid system has also driven a major change in the cooling concept. "On the road car you have five different cooling circuits that are communicating with each other," explains Mohr. "The race car at the end of the day is a little bit simpler than the road car. We have an air-to-air intercooler system and in the road car we have water-to-air."

With the turbocharged engine, Lamborghini has ▶

ABOVE The Gallardo GT3 FL2 was developed by Reiter Engineering in cooperation with Lamborghini's R&D motorsport department from 2013

BELOW In June Lamborghini and Grasser Racing Team won the 24 Hours of Spa for the first time with the Huracan GT3 EVO2

ABOVE Come 2026 the Temerario GT3 will be placed with its key partner teams in series such as IMSA and its GT Daytona Pro class, the GT World Challenge and the DTM



addressed another weakness of the Huracan, in particular the EVO2. The roof-mounted air-scoop of the final version of the car sucked in hot air both from the cars in front when running in a slipstream and also from its radiators. The latter issue was addressed for 2024 when Lamborghini was allowed to add small fins and strakes to the rad exits on the bonnet to take hot air around rather than over the car. But the Lambo still struggled in the slipstream of other cars. Induction is no longer reliant on ram-air effect courtesy of turbocharging.

The V8 in the Temerario drives, like the Huracan's V10, through a six-speed HÖR Technologie gearbox, but with a difference. The Huracan had a longitudinal gearbox while the Temerario has a transverse unit. The change has been made in the name of rear-end aerodynamic efficiency.

The engine, though, has been developed entirely at Lamborghini. Autotechnica Motori (ATM) had a hand in V10s that powered the EVO and EVO2 versions of the Huracan and also the turbo V8 found in the SC63, but it has not had any involvement in the Temerario project.

What happens now

The Temerario was given a shakedown by Lamborghini factory drivers Andreas Caldarelli and Marco Mapelli at Vallelunga in June. They will be the project's development drivers. Prior to the Goodwood launch the first car had completed approximately 1100km over six days of running. Further testing has been planned for Mugello, Barcelona, Jerez and Misano as Lamborghini moves towards homologation of the new car.

The debut of the Temerario GT3 is planned for the Sebring 12 Hours IMSA classic next March. Having it ready for the opening round of the series two months beforehand is, says Mohr, "unrealistic". In year one the Temerario will be raced in the key championships for which GT3 cars are eligible, minus the WEC and its LMGT3 class in which Lamborghini is no longer a player after it was forced to downscale its LMDh programme to an attack on the IMSA enduros only in 2025.

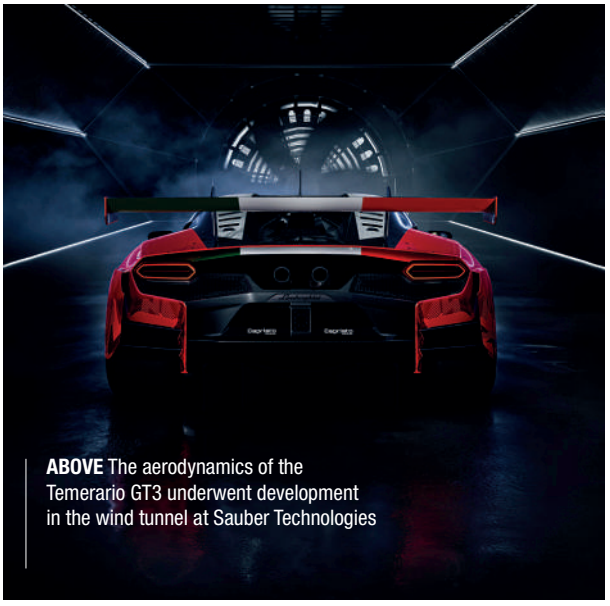
Next year will be a learning year in which the Temerario is placed with its key partner teams in series such as IMSA and its GT Daytona Pro class, the GT World Challenge and the DTM. Expect the likes of the Grasser Racing Team, which scored the Huracan GT3's victory on its debut in the Blancpain GT Series Endurance Cup season-opener at Monza in 2015 and this year's Spa victory in the same series, now the GTWCE, to be racing Temerarios next year.

GT3 rules require a manufacturer to have 10 cars racing by the end of a new car's first season of homologation and a further 10 by the end of year two. Mohr says 10 will be the maximum number available in 2026, but Lamborghini wants to continue the success of the Huracan not just in terms of results but also in terms of the numbers of cars it sells.

"It's clear we designed the car to be competitive but also to be attractive for the customer for the running costs, the price sticker, and from the maintenance point of view," says Mohr. A price has yet to be revealed for the Temerario GT3, but Lamborghini is telling its customers that it won't be a major increase on the Huracan. It appears that, when listed in euros, it will still begin with a four. That will make it one of the cheaper GT3 cars out there.

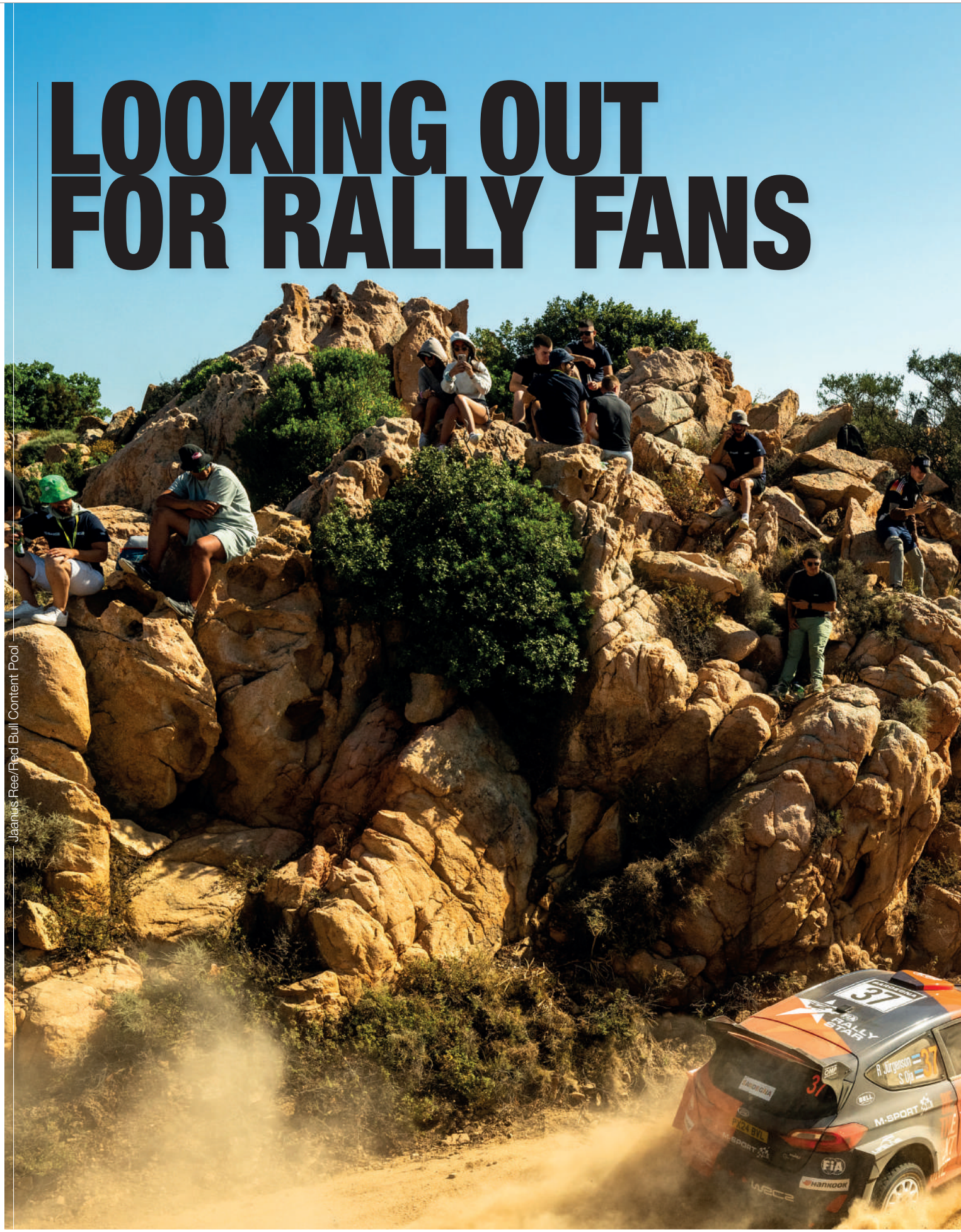
Mohr suggests some manufacturers involved in GT3 aren't interested in producing more than the regulation 20 cars, though he declines to name them. He insists that the Temerario GT3 is a race car that has been built "to be sold". And, of course, to win races.

ABOVE Rouven Mohr calls the Temerario's new four-litre V8 "the most racey turbo engine in the world"



ABOVE The aerodynamics of the Temerario GT3 underwent development in the wind tunnel at Sauber Technologies

LOOKING OUT FOR RALLY FANS



Jaanus Ree/Red Bull Content Pool

The FIA has just trialled an AI-powered safety camera in a rally car as part of its attempts to identify and reduce potential hazards for spectators, as **Chris Pickering** discovers

IT'S one of the most iconic images in motorsport. Hordes of spectators lining the road on both sides as monstrous Group B rally machines kick up the dust, flying sideways towards them. This scene was a testament to the popularity of the sport in rallying's golden age, but it was also the cause of its downfall.

As Ari Vatanen later recalled: "In Italy and places like this, it was difficult to control the fans at that time. But in Portugal, it was impossible. I remember driving the Sintra stages waving my fist at these crazy people in the road. You drive down this human corridor. It was an accident waiting to happen."

Things came to a head in Portugal in 1986 when local star Joaquim Santos in a Ford RS200 swerved to avoid a man who stepped in front of the car. He lost control among the tunnel of spectators. In the ensuing crash, a mother and her 11-year old son were killed instantly, along with another child. A fourth person later died in hospital and 32 people were seriously injured.

While the speeds reached by the Group B cars (famously dubbed "too fast to race") were clearly a contributing factor, the impact forces in the accidents that brought an end to the category weren't unprecedented back then, and neither would they be today. The biggest issue was the proximity of the spectators – many of whom were casual observers there for a day out rather than hardcore rally fans accustomed to the risks.

In the decades that have followed, the FIA and the event organisers have worked hard towards ensuring that everybody who comes to watch a rally goes home safely at the end of the day.

At World Rally Championship (WRC) level, the process starts with a group of cars known collectively as the safety caravan, which passes through each ▶

LEFT Rally fans have always sought every conceivable vantage point to get the closest possible view of the action

World Rally Championship

stage around 90 minutes before the start, with a team of officials onboard to review spectator safety. Closer to the start, three 'zero' cars pass through at progressively higher speeds to check the stage.

Once the first competitive runs begin, live footage from each car is fed to an analysis suite in Rally Control. Here, FIA WRC Safety Delegate Nicolas Klinger has the job of monitoring three different onboard feeds, plus footage from the WRC safety helicopter and GPS tracking data for each car on the stage. Dedicated software allows him to pause and rewind the footage for closer inspection.

On one rally, Klinger spotted what looked like a mobile phone being held underneath an Armco barrier. He contacted the nearest marshal who found a spectator lying against the barrier at road level and guided him to safety. Three cars later, a driver missed their braking point and went into the barriers at the exact location where the man had been lying.

ABOVE How desperate are fans for the best social media shot? In-car cameras capture moments of insanity on the world rally stages

BELOW The FIA-developed Artificial Intelligence Safety Camera (AISC) is a self-sustaining GPU-enabled camera connected to a processing unit

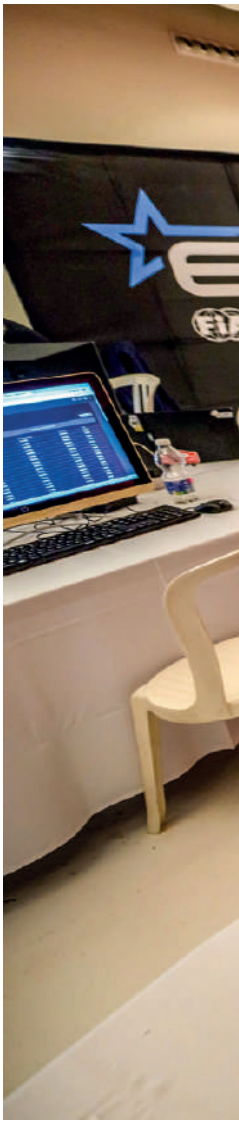
FIA

Mission control

This approach requires a significant amount of infrastructure. More than a dozen people work in Rally Control on a WRC event. The scene resembles launch control at NASA, with rows of desks and banks of screens. It's a huge undertaking, which dwarfs the resources at most regional and national rally events, where there often isn't the technology or the manpower available to collect and review footage in real-time.

"The WRC system works very well, but it can't be scaled to national-level competitions. What we needed was something that would work for FIA regional championships and one-off events. These are often the most challenging situation, because the drivers are not necessarily so experienced and the organisers don't have the same level of resources to keep the spectators informed," explains FIA safety director, Nuno Costa.

Around five years ago, the FIA began investigating whether AI-based image recognition software could be used to automatically identify potential hazards from a forward-facing camera mounted on the car. Initially the plan was to develop this technology for the WRC,



> *"The FIA has worked hard to ensure everybody who comes to watch a rally goes home safely"*

but the project was delayed – and the decision was taken in 2023 to refocus its development on lower level events that don't have the resources to review all the footage manually.

The result is the FIA's new AI Safety Camera (AISC), developed in partnership with the FIA Foundation and Croatian tech firm Calirad. First deployed at the opening round of the 2025 FIA European Rally Championship (ERC) back in the spring, it has since been used at every ERC event.

The eyes of the system are three cameras mounted in a single unit to provide stereoscopic vision. These feed images back to a control unit at the rear of the car, anchored to the roll cage, which contains a CPU for general processing, plus a dedicated GPU for image analysis. On the roof of the car, there's a GPS antenna to provide location data plus a 4G antenna to transmit data back to Rally Control. In total, the system weighs around three kilos and is completely self-contained, with its own battery power supply.

The AISC constantly scans the road ahead while the car is on the stage. If a potential hazard is identified, it is automatically transmitted back to Rally Control as a still image. There, it is reviewed by the chief safety officer and the local ASN's safety delegate using a web-based interface.

"The first task when a snapshot comes in is to identify whether it's a genuine issue or a false positive," explains Clément Lauté, head of operational safety at the FIA. "Then we have a workflow to address the problem. Most of the time, the solution is to call the nearest marshal and they can resolve the issue. We can pinpoint the location on a map that is part of the interface and then mark it as closed once the situation has been solved."

Each potential hazard is logged on the system's ▶

BELOW The AI Safety Camera offers officials real-time, stage-level insight into spectator locations using AI-powered human detection

FIA

FIA

server and the full video footage is available to review after the event.

"What we're really pushing is to get to the point where we can review and improve not just for the next event, but ultimately between the first leg and the second leg too," comments Costa. "We want to manage the rally live and improve from one leg to the next rather than looking ahead to the next event. That's a very dynamic concept that's quite different to the way it has been done before."

> *"The system's eyes are three cameras mounted in a single unit to provide stereoscopic vision"*

Harsh environments

The biggest technical challenge, Lauté explains, has been the environmental conditions that the system has to face. Beyond its current application in the ERC, the wider world of rallying ranges from the Arctic cold of Sweden, where temperatures can drop to -20 deg C, to the sweltering heat of Mexico where it's not unusual to see +60 deg C inside the car. There's also the dust to contend with in places like Greece and Kenya.

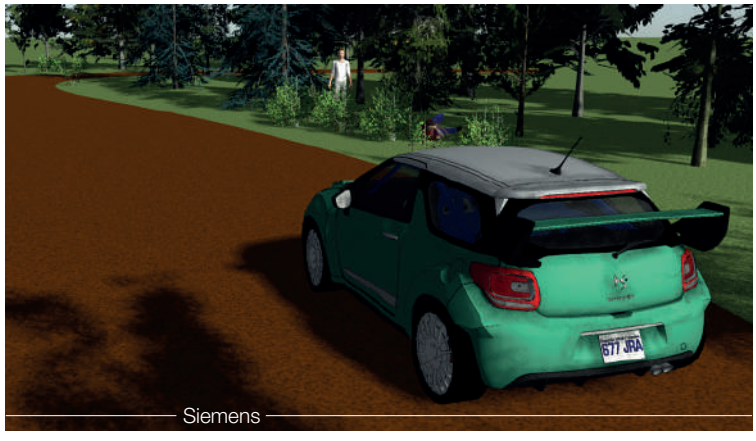
Another consideration came from the communications system, which needed to be compatible with every major network around the world, with different frequencies and protocols. Standard mobile phone networks are used, which also means the coverage isn't always consistent.

"The network coverage is really challenging," admits Lauté. "There are places like Wales where a lot of the terrain runs through forests. And you can have a very strong network with good quality 4G that's not designed to be overloaded with thousands of spectators all using the same antenna. So there will always be some places where you struggle, even with good coverage on paper. We also have some events running close to national borders, so from time to time the signal might switch from one country's network to another. Overall, though, I would say the coverage is good."

To cope with these dead spots, a Starlink satellite internet module is placed at the end of each stage. This means that even if there is no signal for a ▶

ABOVE The system captures spectator locations and transmits alerts to event officials so pre-emptive safety measures can be taken before the next competitor arrives

BELOW Early tests of this technology back in 2019 involved PreScan software by TASS International, a Siemens business, here simulating a rally car with two spectators at the roadside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majority of the stage, any alerts will still be sent to Rally Control as soon as the car crosses the line.

The system was initially tested with standard production cars on the public road. Having shown promise, it was used on test sessions for the WRC and the ERC, before being trialled in competitive events. The harshest test, Lauté explains, was use during a live WRC event. Here, the system not only had to cope with higher numbers of spectators around the stage, but also greater network traffic.

Another key point was that the system needed to be user friendly, he explains: "We wanted it to be easy to use for the chief safety officer and the safety delegate, because at the end of the day, it needs to work for them. It would have been quite easy for them to push back and say they didn't want to use it."

> *"This is intended to protect people against risks that they might not even realise are there"*

Testing times

The AISC is currently used on five cars at each ERC round and the feedback so far is said to have been positive.

"[The technology] is working well, we've shown that it can pick up people hiding in the bushes and things like that. But it's still very new. After each event, we still find something we want to improve," notes Lauté. "At the moment, we're collecting a lot of images, so it's a lot of work for the people reviewing them. We'd prefer it to be on the safe side – the last

Red Bull Content Pool

BELOW The camera made its debut at the first ERC event of the year, the 42nd Rally Sierra Morena

RIGHT Rally fans will still be able to get close to their heroes but this system will be on the lookout for safety issues they may not have noticed

BELOW RIGHT A Starlink satellite internet module is placed at the end of each stage so alerts will be sent to Rally Control if the signal drops on the road

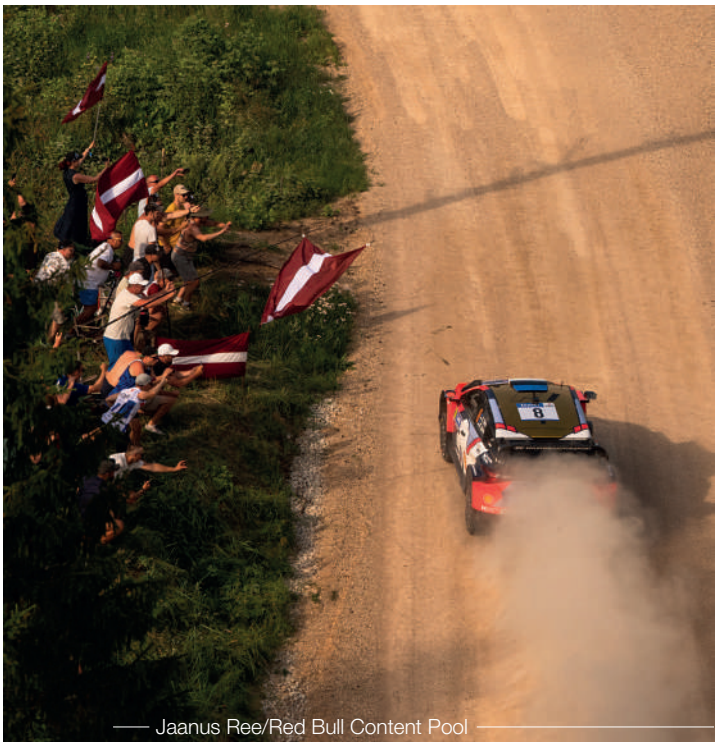
thing we want is to miss hazards – but we want to improve the filtering to reduce the number of false positives."

The ultimate aim is to roll the system out to lower level events, such as national championship rallies and beyond.

"We know the organisers of smaller events are keen to use this system as well," comments Costa. "The way we tend to work is that we use the high-level events as a laboratory to make the technology work. Then, the next step is to make them available for the national events.

"The beauty of this system is that it's completely autonomous. We still need people with the same skill set at Rally Control as we would have at a WRC event, but this allows them to manage spectator safety without the same level of resources."

Costa stresses that the FIA is looking to work with spectators to improve everyone's safety and enjoyment of the sport: "Over the years, we've built up a lot of knowledge about spectator safety. A lot of work is done before each event by the organisers, the ASN and the FIA to prepare the special stages and to identify the best place for spectators to sit, but we also know that people tend to move... and sometimes they move to places that aren't safe. This isn't



Jaanus Ree/Red Bull Content Pool

intended to punish people, but to protect them against risks that they might not even realise are there."

It's easy to see why organisers and marshals need to tread carefully when dealing with spectators. Nobody likes being told what to do, and the hazards of motorsport can seem remote now that spectator injuries are mercifully rare. It wasn't always that way, though, as the history books can attest.

FIA

DR IN THE HOUSE

Anthony Peacock speaks to Prodrive chief David Richards, whose lifelong impact on global motorsport stretches far and wide, from rallying to F1 to Dakar's deserts

TWENTY years ago already – although it somehow feels much more recent – David Richards had already done enough to fill a 256-page book: specifically his biography *Driven Man*, written by the late, great Alan Henry and published in 2005.

But so much has happened since then to cement his legacy. And perhaps the most interesting chapter in his story – and that of Prodrive – is still to come. At least that's what the man himself says.

Since 1984, Richards has built Prodrive into something far more significant than just a successful racing or engineering firm. Instead, it's almost been a motorsport movement, which has made Richards' philosophy felt on the political stage as well. So what makes Prodrive so special?

"That's an interesting question," he says. "I'm not sure I've ever properly considered it before, but I'd say it comes down to the people. From the very start I surrounded myself with individuals who genuinely care. Not just about the work, but about each other. At Prodrive the structure is flat, not hierarchical. That, I believe, is the essence of what sets us apart."

Such a sentiment might sound overly idealistic, especially in a world where tenths of a second can cost millions and frustrations are regularly tested in the heat of competitive emotion.

But Richards doesn't believe in hierarchy for hierarchy's sake. Instead, he reckons that leadership is built on accessibility rather than raw authority or concentration of power.

"I've been involved with many, many other organisations over the years," he adds, "and I can see a distinct difference in culture here."

That mindset – quiet, consistent, people-focused – is why Prodrive has not just survived four decades, but thrived. It's why it has become a partner of choice for global brands like Subaru, Aston Martin, MINI and, most recently, Land Rover.

"Longevity plays a role; we've been at it for 40 years and this gives people confidence," says Richards. "But more importantly, you can't behave like a maverick outfit and expect to win the trust of manufacturers. We learned fairly early on that large manufacturers expect a certain level of stability and governance."

> *"At Prodrive the structure is flat, not hierarchical. That's what sets us apart"*

Ask him which his favourite was and the answer is as predictable as it is polished: "That's like asking me to pick a favourite child: I've got three, and I wouldn't dare choose between them!" he laughs. "I always say, a bit glibly, the best moment is still to come. Who knows, maybe we'll win Dakar this January!"

He's only half joking, and this is yet another subject we will return to. But there are moments and reminiscences that are more serious too. And maybe he does have a favourite moment after all... "This year marks 30 years since Colin McRae won the championship," he points out. "That was definitely one of the highlights of my career."

McRae. The name alone brings with it a rush of gravel-slinging images and memories of impossible bravery. But to Richards, McRae was never just your average superstar. He was part of the furniture, who came of age within Prodrive.

"He started off helping out when his dad, Jimmy, was driving for us. He'd drive the service van to events, working behind the scenes and doing all the dirty jobs."

Richards takes a quiet pride here; not just in what McRae achieved, but in how he did it; almost as a member of his family. So it was no surprise that McRae, just before his untimely passing, was on the verge of returning to the team that helped raise him. ▶

LEFT David Richards has enjoyed a motorsport career spanning nearly 50 years yet he is always looking towards the next challenge

"It was hard when Colin left for Ford at the end of 1998; he'd achieved so much with us," remembers Richards. "But fast forward a few years later; we flew down to Goodwood together just a week before his accident and discussed the details of him coming back to Subaru. He was set to test the car two weeks later."

The weight of that unfinished story still hangs heavily. And McRae wasn't the only one.

"Richard Burns too; he was set to rejoin Prodrive in 2005," adds Richards. Two great champions, both of whom were on their way back to us and woven into our fabric. That still hits hard."

What emerges from those stories isn't just a sense of loss or opportunities missed: it's a powerful testament to Prodrive's pull and legacy. Whether you are a world champion or not.

"A lot of young engineers join us, gain incredible experience, and many go on to Formula 1 or other big teams," points out Prodrive's founder. "And when they move on, I try personally to do an exit interview with as many as I can. They come in looking nervous, expecting a telling-off, but I just say: 'Good luck. I've done Formula 1 myself. But if you ever get tired of working on the same front-left suspension part for two years... come back.' Many of them do exactly that. Just the other week, someone walked up to me in the workshop and said, 'David, I'm back! Remember me? I've been gone eight years.' That's the culture we've built – and I'm very proud of that."

The latest adventure that Prodrive is embarking on is the Defender Dakar project, having previously tackled the epic event with its own Prodrive Hunter and the Prodrive-run BRX team, and now the Dacia Sandriders programme (which will continue into next year and beyond, giving Prodrive the opportunity to run two quite different Dakar programmes in parallel).

The Defender project started with a problem, and a subsequent chat with some influential people about how to solve it. That's how these things usually begin.

"We were doing Dakar and a guy named Liam Griffin, whom we knew from GT3 racing, was competing in the side-by-side category," recounts Richards, a natural born storyteller. Griffin had the talent, but not the platform. The top-tier cars, like the Dacia, were too expensive. The lower-tier vehicles were uninspiring. Richards, ever the problem-solver, saw a space in between, bridging the gap between buggies and the top level of cars... "So I thought: why not create a kind of Group N-style rally-raid car?"

As a result, Land Rover's Defender will officially enter the Dakar Rally and the FIA World Rally-Raid Championship (W2RC) as a full factory team from 2026 until at least 2028, with two Defenders competing in all five rounds of the W2RC and a third vehicle joining the team specifically for the Dakar Rally. Defender already dipped a toe in the water by becoming the Dakar's official car partner from this year, where it provided support vehicles, media transport, and recce vehicles used for route planning.

> *"There's no point in unsustainable sustainability"*

Following on from Richards' idea, the Defenders being developed for competition will race in the "Stock" category, based on production-based models and aligned with new 2026 regulations.

But the biggest coup is perhaps Prodrive's signing of 14-time Dakar champion Stéphane Peterhansel, who missed the event for just the third time in 37 years last January after Audi pulled the plug. Joining

Kin Marcin/Red Bull Content Pool

LEFT The Dacia Sandriders programme is set to continue so Prodrive will run two quite different Dakar programmes

RIGHT Richards insists Prodrive thrives because of its people – shown in the composites department – with a structure that is 'flat' rather than 'hierarchical'

RIGHT Land Rover's Defender will officially enter the Dakar Rally and the FIA World Rally-Raid Championship as a full factory team from 2026

him will be young talent Rokas Baciuška and American driver Sara Price.

But it wasn't an easy sell. Dakar's organisers feared this middle-tier idea would dilute the drama (not to mention the revenue). "David [Castera, Dakar director] flat-out said he didn't want underpowered cars getting stuck in the dunes again," remembers Richards. "But I persisted. I said: 'Update the regulations, modernise the approach. These won't be the standard showroom cars you're thinking of; they'll be proper race-prepped vehicles. I took it further, to Yann Le Moenner, the CEO of the ASO [Dakar's organising body] and made the case that this would bring in new manufacturers and drivers. GT3 is a great example: open up the field, lower the barriers, and the whole ecosystem flourishes. I always say don't just ask: 'What's in it for me?' Ask: 'What's in it for the sport?'"

Richards, patient as ever, eventually wore them down, and brought other new manufacturers into the fold. He invests a lot of time in talking. Even when we speak for this interview, he's got a sore throat and a slight bug, but he gives his time generously and expansively.

It was talking that led Ryuichiro Kuze to sign Subaru up for world rallying back in 1989. In 2010 Richards managed to convince MINI to do the same. His powers of persuasion are nothing short of extraordinary, and these powers have taken him quite literally to the ends of the earth.

The Defender, the desert, the romance of Dakar, and the experience of Prodrive: it all fits perfectly. Richards has already made a bet with Castera. "I bet him that one of our 'Group N' spec Defenders would finish in the top 20," he grins. "We'll see who wins."

Spoiler alert: history has shown it's normally the 1981 World Rally Champion Co-Driver. ▶

JLR

Which is why his highly-publicised criticism of the current FIA President is worthy of such note, having penned an open letter earlier this year about his concerns over the federation's governance and general direction of travel. It's a controversy that has put Richards in the eye of a political storm, not for the first time in his life.

"The original manifesto was meant to modernise the FIA: instead things seem to be heading in the opposite direction," he points out bluntly.

His critique of the current leadership under Mohammed Ben Sulayem is measured but very direct and unequivocal. The vision has been lost, he believes. The machine is slipping back into its old autocratic habits.

"It was disgraceful," he says of how former FIA Vice President Robert Reid (another former Prodrive-Subaru star, alongside Burns) was sidelined. "Robert was cut off because he dared to challenge decisions, while doing his job with competence and integrity."

That's viscerally antithetical to the personal philosophy that Richards has instilled within Prodrive: where challenge and dissent is encouraged rather than punished.

As a result of these very public statements, many people have surmised that Richards himself will be mounting a challenge to Ben Sulayem when the presidential elections take place later this year.

He won't, for a number of reasons. Ben Sulayem recently reduced the maximum age for an FIA President from 75 to 70, thereby effectively barring the 73-year-old from standing. This the man himself graciously takes as a sort of backhanded compliment – disqualification is, after all, probably the sincerest form of flattery – not to mention amusement, as the tactic has broadly backfired.

Charly Lopez/DPPI

LEFT One of Prodrive's most enduring relationships is with Aston Martin, still designing and manufacturing the Vantage GT3 and GT4 cars for independent teams

"The funny thing is, by doing that, he's actually highlighting me as a straight dealer," points out Richards. "I've not got any skin in the game – so it just shows that anything I say isn't for personal gain or my own agenda. I simply say things as I see them."

For the record, Richards confirms that "nothing has changed; in fact it's probably got worse" since he authored his letter; where he lamented "the erosion of accountability and good governance within the FIA"; even threatening potential legal action unless things changed.

The other reason he won't be standing is a simple

Prodrive

BELOW One of DR's finest hours came when Colin McRae clinched the WRC title in a Prodrive Impreza at RallyGB in 1995

fact of biology; 'DR' has reached the age where another full-time job in the front line simply doesn't appeal any more. But that doesn't necessarily mean Richards will be stepping back completely. Because that would be against his nature.

In what exact shape or form his political career will evolve is harder to predict. Yet he refutes any form of run for office categorically, pointing out that he's got enough to deal with in his present role and in his family life, which has often had to take a back seat in a multi-faceted motorsport career that has spanned nearly 50 years.

There's a surprising point at which these two considerations intersect, which is energy transition. "I always say I want to be able to look my granddaughter in the eye and say: yes, I burned a lot of fossil fuel, but I also worked on solutions."

So, partly down to its owner's personal convictions, Prodrive's Advanced Technology division is building EVs, hybrid vans, and soon, a new sustainable platform – ELM Mobility – that could reshape the firm's direction. But he's cautious, pointing out "sustainability has to be viable economically as well as ethically."

This pragmatism is an essential antidote to greenwashing; there's no point in having unsustainable sustainability. It especially applies to rallying, the branch of motorsport perhaps closest to Richards' heart, where unchecked spending has essentially driven out privateers – once the sport's lifeblood – from the top level.

When 'DR' won the WRC title in 1981 with Ari Vatanen, their Ford Escort was run by the independent David Sutton team – which was able to beat international giants such as Fiat and General Motors.

"We gave manufacturers too much freedom," ▶

ABOVE Ever looking forward, Prodrive is investigating future technologies such as hydrogen and sustainable fuel, the latter trialled here on the dyno

BELOW Since winning the World Rally Championship in 1981 with Ari Vatanen, Richards insists the lessons of co-driving have helped him in business

Reinventing the rules

THE 2027 World Rally Championship will mark a transformative chapter for the sport, as sweeping new regulations take effect. These changes bear the unmistakable influence of Richards, who sits on the World Motorsport Council – at least on the occasions when he isn't excluded from meetings for failing to sign an NDA. That's the situation that both he and Reid found themselves in, which led to the former's open letter and the latter's resignation.

The new WRC rules, which come into force from 2027, represent not just a technical pivot, but a strategic realignment of the WRC's priorities – centring around cost control, flexibility, accessibility and long-term sustainability – each closely tied to Richards' enduring philosophy on the sport's future.

At the heart of the overhaul is the adoption of a standard steel space-frame chassis formula for Rally1 cars. This move, championed by Richards, signals a clear break from the complex and expensive bespoke chassis designs that have defined the current era. Under the new model, manufacturers will build rally cars around a shared FIA-homologated space-frame, dramatically slashing development costs and enabling a broader range of vehicle shapes, from hatchbacks to crossovers.

WRC Promoter GmbH/Red Bull Content Pool

Richards has advocated this change as a means to democratise competition, allowing manufacturers to maintain brand identity while controlling ballooning engineering costs. The target cost of €400,000 per car is a direct result of Richards' push for affordability while enhancing the spectacle of WRC competition.

This figure represents a near-50% reduction compared to current Rally1 budgets and puts top-tier rallying within closer reach of privateer teams

But Richards' strategic vision goes far beyond vehicle specs. The new rules embrace a reimagined sporting format, with more agile remote service areas using minimal equipment and people.

Behind closed doors, Richards' role as co-chair of the FIA's working group to determine the future of rallying was central to this revolution. Many of the key decisions emerged directly from the frameworks he helped define. But of course he's been there before, heading up ISC (WRC's commercial rights holder at the time) in the 2000s and sparking the digital revolution that basically redefined how we watch the sport.

What's notable is how Richards' personal philosophy has evolved over the years. Once a staunch advocate for centralised control and factory-driven rallying, he has since embraced a more pluralistic, grassroots-friendly vision. His recent vocal criticisms of FIA governance and involvement in legal efforts to challenge opaque decision-making reflect a broader commitment to transparency and inclusivity; principles now embedded in the 2027 regulatory framework.

For manufacturers, the new rules offer a more sustainable business case and creative freedom to tie competition vehicles closer to showroom models. For privateers, the barriers to entry are finally lowered, renewing the possibility of independent teams contending at the highest – maybe even championship-winning – level.

For fans, the result will be a richer tapestry of cars, more dynamic event formats, and the same high-stakes drama that always defines the WRC: only now with more variety and less financial gatekeeping.

In many ways, the 2027 season represents the culmination of David Richards' enduring vision: a World Rally Championship that respects its legacy, meets the challenges of modern motorsport and reopens the door to innovation and global growth.

BELOW LEFT Richards still sits on the World Motorsport Council – at least when he isn't excluded for failing to sign an NDA

BELOW The World Rally Championship is set for a major regulations shake-up in 2027

is how Richards explains away what happened next. “Costs spiralled. The privateer market died. There was a time, not long ago, when we had 380 Subaru customers. We rebuilt 300 engines in one year. Malcolm Wilson was doing the same. Today? There isn’t a single privateer who can run a competitive equivalent of a works car in the WRC. On top of that, you’ve got environmental scrutiny. And let’s be honest, car manufacturers are shifting to EVs. The types of cars that worked in rallying before simply aren’t being made any more.”

But he hasn’t given up. He’s been closely involved in drafting the new WRC regulations for 2027, which aim (in part) to level the playing field and bring the sport back to its roots.

“The goal is simple,” he points out. “Stop manufacturers from winning just by spending the most money.”

In the meantime, he’s been quietly planning his own exit strategy. “People say I’m the face of Prodrive, but I’ve actually spent the last few years handing over the reins,” he says. “Luckily, that’s not too hard a job as I’m fortunate to be surrounded by a team of absolutely brilliant people.”

He’ll still drop into Le Mans. Maybe the Isle of Man TT. But more and more, his time is being spent elsewhere: mentoring, education and charity work, including the Cornwall Air Ambulance and i-Neuro, a neurological trust. He and his wife Karen own a couple of hotels in Cornwall, their favourite retreat, where you’ll find them driving around in nothing more powerful than an old Morris Minor.

“You’ve got to give back to the community that helped you succeed. And this is something you realise more and more as time goes on,” DR points out.

That requires a somewhat detached attitude: the owner of a motorsport preparation firm convincing the world that manufacturers need to spend less on motorsport seems on the face of it counter-intuitive.

But maybe this grasp of a constantly-shifting bigger picture comes from having a co-driving background, just like Jean Todt, Robert Reid, and even Luca di Montezemolo.

It’s a point that’s been made many times before.

“Being a co-driver teaches you to stay calm under pressure,” he agrees. “That transfers to leadership naturally. So maybe there’s something to that.”

Then, almost as an afterthought, he adds: “Ultimately, building a great team is about understanding and supporting each individual. Making sure they can be their best.”

Whatever you think of David Richards, nobody can deny that he has created an incredible number of opportunities over the years, thanks to the combination of a golden mind and a silver tongue.

Defender and Dakar is just the latest iconic combination to roll out of the workshops at Banbury. And, whether as a full-time player or just the power behind the throne, DR isn’t quite done yet. RT

Jaanus Ree/Red Bull Content Pool

RALLYCROSS EXAMINATION

Hal Ridge meets senior FIA officials to hear about the technical direction being taken at the top level of global rallycross – and its potential crossover with the WRC

SIGNIFICANT moments in history are so often marked by a memory of what you were doing at the time you found out. The Queen's passing, your favourite football team finally achieving success after a decades-long barren spell or perhaps the 2021 Formula 1 title showdown in Abu Dhabi.

In the summer of 2018, the significant piece of history relevant to this piece wasn't France winning the World Cup in Russia or Manchester City taking a stranglehold on the English Premier League; nor was it rising F1 sensation Max Verstappen becoming a four-time grand prix race winner.

At the end of August that year, then Audi Sport boss Dieter Gass dropped a bombshell during a telephone call: that Audi would be withdrawing its works effort from the World Rallycross Championship.

The series, then promoted by IMG and in collaboration with the manufacturers and the FIA, was in the midst of a planned transition to electric technology. A few weeks before Audi's news, the championship announced the postponement of a technology shift from 2020 to 2021 to give manufacturers more time to commit. The intention was for single-specification composite chassis to be used at the discipline's highest level, fitted with electric powertrains.

Audi's news was another bump in the road, but when Peugeot withdrew from the series in October and Volkswagen followed suit, the road became much more unstable... and World RX has not fully recovered since.

It's not all negative; there have been some amazing seasons since the end of 2018. But World RX has since been without manufacturer input and the commercial rights switched from IMG to Rallycross Promoter GmbH (an offshoot of WRC Promoter). Then the much-delayed and revised electric transition that eventually did happen for the 2022 campaign didn't take off in the way it had been hoped, not helped by the huge fire during the UK round at Lydden Hill in 2023 that destroyed the Special One Racing Team's Lancia Deltas.

Internal combustion RX1 (Supercar) machines returned in 2024 in a 'Battle of Technologies' pitching more traditional cars directly against the electric RX1e incumbents in a bid to boost entry numbers. But next, over the most recent off-season, the FIA terminated the contract of Rallycross Promoter. Then, having undertaken a tender process to find a new commercial rights holder, ultimately the FIA ended up taking over the promotion of the series itself.

That's a very brief overview; a whole series of books could and probably should be written about what has gone on since rallycross gained FIA World Championship status in 2014, and a separate tome could be dedicated to what has happened since 2018.

Right now, World RX is in a transition phase, not only with FIA fully steering the mixed-surface ship, but with new technical regulations on the horizon too.

The Battle of Technologies has brought its own complications, but arguably the concept has been a sticking plaster anyway. The RX1e regulation set to which the current electric World RX machines run, with powertrains delivered by Austrian firm Kreisel, has under-delivered. 14 powertrain kits were created by FIA tender winners Kreisel but, even accounting for two RX1e cars that have never actually turned a wheel, only 12 have ever been produced, with a maximum of 10 cars entering events.

The talk of the paddock in early 2025 has been about the current EOT (Equalisation Of Technologies) balance, but what is more key is that the powertrain supply tender that Kreisel won was for a four-year cycle, which ends this year.

Park some of that for a moment though, as we'll come back to EOT in 2025 shortly...

Cross pollination

In December last year, after much debate surrounding the future of rallying's top level in the World Rally Championship, the FIA World Motor Sport Council revealed the outline of new technical regulations for the discipline to come into force after 2026. Entitled 'WRC27', in a nutshell the new rules are aimed at reducing costs, utilising

FIA

> *When Audi, Peugeot and Volkswagen withdrew, the road became much more unstable"*

single-specification spaceframe chassis and safety cells that can fit any scaled composite bodyshell. In time, it will be home to a range of technologies too, although it will begin with a conventional internal combustion engine, powered by sustainable fuel.

Yet the foot of that press release contained a key statement that read: "The regulations approved by the World Motor Sport Council lay the groundwork for the potential for crossover between the FIA World Rally Championship and the FIA World Rallycross Championship. While it would still require further approvals and updates, the rules set the stage for a manufacturer or a team to run concurrent programmes, potentially with different powertrains catering for the specific needs of each championship. In combination with a boost to grassroots off-road competition through the FIA Affordable Cross Car initiative, the regulations coming into effect from the 2027 season onwards are set to secure a dynamic future for rally competition, making it more exciting, accessible and safe."

With all the discussion around the change in series promoter, EOT and the number of entries in the early part of the current campaign, series bosses could be forgiven for putting 2027 on the list of lower-priority problems.

But, as FIA Road Sport Director Emilia Abel told *Race Tech* in an exclusive interview during the Swedish round in July, the way the regulations are being shaped is front and centre of the FIA's rallycross endeavours.

"It's actually not too early [to be discussing the future of the regulations]. We know all about that from the technical perspective and we have actually had two days of meetings with all the teams from World RX and select teams from Euro RX as well, especially to discuss 2026 and then the new regulations from 2027," explained Abel, before handing the conversational baton to FIA Technical Engineering Director, Thomas Chevaucher.

"There was already quite a bit of communication ▶

BELOW The FIA World RX series – pictured at Sweden's Höljes – features a mix of electric and ICE machinery

around the 2027 regulations for the WRC," adds Chevaucher. "We are planning to share as much as we can between the two regulations. For example, the big new thing for WRC27 is the way we are doing the chassis and this will be transferred to World RX from 2027 onward [too].

"There are some specifics to rallycross that will lead to a small variation of the regulation, but that will be very marginal. The idea is really to offer the possibility to both WRC manufacturers and teams and the World RX manufacturers and teams to have a communality: to be able to work together and potentially to have the possibility to move from one championship to another with the very similar cars.

"So this is really something we are working on. There are still some question marks regarding the modifications, one of them being the engine. We know the power of the two cars is different so we are trying to address that. It's a bit early to answer exactly but I think the key idea of the WRC27 is to have a cost control car for WRC. The idea is to apply the same principle to World RX because we think reducing the cost is not only good for WRC, but it would also be a very positive for World RX."

Abel is quick to point out that World RX won't be going for a hard switch in 2027, instead adopting a yet-to-be-defined transition period where existing machines will continue to be accommodated. What is also clear is that when the WRC27 concept is introduced to rallycross from 2027, it will only be for internal combustion engine machines, despite being future-proofed to adopt alternative technologies.

"The chassis and safety cell have been designed by the FIA. We have done simulations and we are currently preparing the physical crash test to make sure all is fine. That safety cell will be the same design for everyone to control costs, then the front and rear parts of the chassis will be developed by each manufacturer," adds Chevaucher.

"The concept is that the chassis has been designed to be compatible with different technologies. That same chassis would apply to World RX so the compatibility will also apply to the WRC. Still, the beginning of the cycle in WRC will be full ICE with sustainable fuel until a certain point where we might open to different technologies. The same principle will apply to World RX, where it will be fully ICE sustainable fuel in the first instance; then we have the possibility to open up for the future."

Welcome arrivals

Few new RX1 (Supercar) machines have been created since the end of the manufacturer era, with the notable exceptions of an R5-derived Proton Iriz by Team RX Racing in the UK and a Volkswagen Polo from World Championship winning team Kristoffersson

RIGHT The appeal of rallycross lies in its demands to take on a wide range of track conditions, often on the same lap

BELOW The FIA has to balance performance of electric cars such as Klara Andersson's CE Dealer PWR RX1e and with the ICE of Patrick O'Donovan's Peugeot 208

Petr Šulčík

Jan Kaare Rafoss

Motorsport, so newly shaped machines will be a welcome addition to the discipline. Indeed the ICE cars racing at the top of the World and European Championships right now are almost all machines built by or during the manufacturer boom.

As mentioned, those ICE machines are going up against the RX1e cars that were introduced in 2022. Just like in any series with a balance of performance, the equalization technology currently at play in World RX is a divisive topic, with Kristoffersson's ICE machine a key part of the debate.

Significant effort has been put into the EOT balance by the FIA. Trying to achieve equilibrium between two totally different technologies featuring powertrains with divergent characteristics – all on tracks that have different surfaces that change with every lap – is a far bigger challenge than delivering a success ballast concept to a circuit racing series with stable conditions, for example.

Led by support from commercial partners, Kristoffersson Motorsport reverted to ICE for 2024 with its Polo 601 RX, detailed in *Race Tech 286*. As part of the FIA's EOT effort, the 601 RX was run in ▶

RIGHT & BELOW RIGHT Spot the difference: the FIA is exploring ways to dovetail World RX (right) and the World Rally Championship machinery from the 2027 season onwards

Hansen Motorsport

Jaanus Ree/Red Bull Content Pool

FIA

a pre-season test at the first-round venue, Lousada in Portugal, alongside the other cars in World RX.

Chevaucher explains: "EOT started last year when the ICE came back. We were missing data and we know the beginning of the year was a bit challenging, so the decision was made to go for a new EOT defined based on what we had and on discussions with the different teams. In hindsight, we think it could have been better. So we decided to do things differently, first trying to balance the starting point a bit better.

"Last year we had a huge mass difference between the two technologies. Basically mass and power are the main differences in World RX. What's unique about rallycross is that the conditions are so different from one track to another, one day to another, you might balance well on one track but it might be more difficult in another. So our aim was to close up the gap between the mass of the two cars. Then we organised the EOT test in Lousada – a representative track – two weeks before the first race.

"We got huge support from all the teams to generate as much data as we could to try to understand the best way forward. We had what we call the reference car, a World RX regulated Peugeot 208 WRX, even if it was not racing, and we worked with the experienced Andreas Bakkerud as a reference driver.

"Each team did its own tests and, without warning, we took some cars into parc fermé that were then refuelled or recharged, depending on the car. Then we sent them out on what called an EOT run to compare it with the reference car that was never modified for the whole test. After we'd run the two or three cars under comparison, we sent out the reference car to assess the track evolution, all driven by the reference driver.

"This allowed us to have an overview not of the pure performance of the car, but of the performance of the car compared to the reference car, thus levelling out the performance of the track. That's probably the best way to assess the performance. There are limits but we think the point we've now reached is reasonable."

ABOVE Electric machinery such as the Hansen Motorsport Peugeot 208 RX1e continues to dominate in 2025 but its days are numbered

Electric competition

The opening weekend was always expected to favour the electric cars, with a long, high-grip tarmac start straight and a high-commitment first corner. Even with the EOT administered, meaning a minimum weight of 1365kg for the ICE machines and 1410kg for the EV – with a maximum permitted EV power output of ▶

Petr Šulčík

BELOW Ready for the off: FIA World RX is preparing for a new era focusing on ICE machinery from 2027

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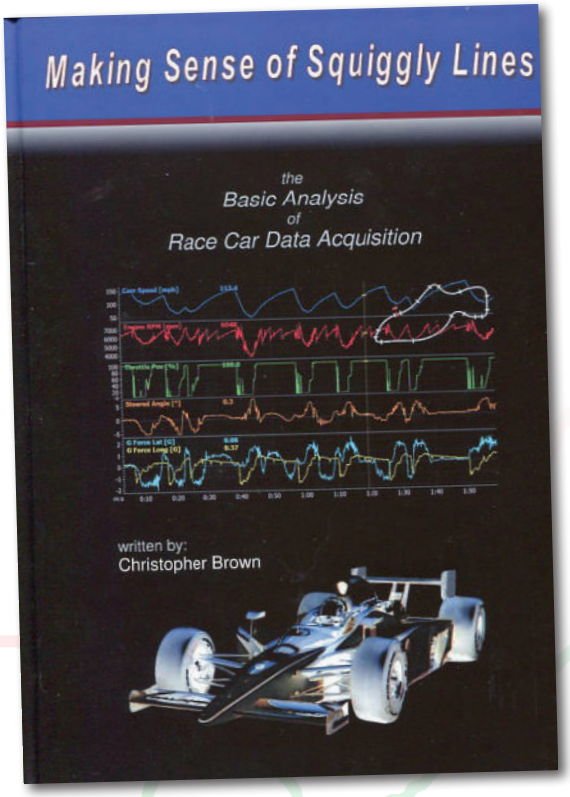
The Basic Analysis of Race Car Data Acquisition by ***Christopher Brown***



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> *"What's unique about rallycross is that conditions are so different from one day to another"*

465kW – it was CE Dealer Teams' Niclas Grönholm who dominated the weekend in his electric PWR RX1e.

KMS' Ole Christian Veiby made the podium but Kristoffersson was only fifth, in part due to a poor Q1 grid draw and the being held up by traffic in the final, though his pace was evident from clear runs in Q4 and his semi-final. Sure enough, at the second and third rounds in Sweden and Hungary, Kristoffersson dominated. But by then, the KMS squad, displeased with the EOT balance, had swapped to its electric car.

"Our ambition is always to give ourselves the best tool for the job," said KMS boss Tommy Kristoffersson ahead of the Swedish round. "When the sporting regulations for the 2025 season were presented in Portugal, it was too late to prepare the KMS Volkswagen RX1e cars in time for the first event. So KMS will take advantage of a new paragraph in the sporting regulations for this year and now switch technology for the second round in Holjes."

Balancing act

While KMS' World Rallycross Championship winning RX1e (electric) and 601 RX (ICE) share external aesthetics, basic chassis geometry, Sachs dampers and Alcon brakes, the cars are clearly home to very different powertrains. Would the results have been different in Sweden and Hungary had Kristoffersson been in an ICE machine? We will never know, but it is also clear that he is the driver of his generation and currently on target to fight for an eighth title in nine years.

Chevaucher is, though, quick to point out that the EOT concept is not about trying to halt one driver's dominance.

FIA

ABOVE LEFT FIA bosses are hoping that World RX (above) will draw closer ties with national series such as British Rallycross (below)

LEFT Johan Kristoffersson is chasing his eighth title in nine years but the FIA denies its technical changes are designed to slow him down

LEFT Few varieties of motorsport offer the same intensity of close-combat competition as FIA World RX

FIA

"We have to take care that we are not balancing the result," he says. "That's an important point. Instead we are balancing the potential performance of the technology. For this aim, we are using the data we have available for all technologies."

If Kristoffersson or team-mate Veiby wins the world championship this year, it will be the first time a driver has done that using two different technologies in the same season... and also possibly the last. While the rule set coming together for 2027 will be for ICE machines, it is still yet to be confirmed whether the RX1e cycle will be extended by a year into 2026.

"We are working on firming up a clear plan for the teams for the medium term. 2027 is taking shape now, and once we have that clear plan explained to the teams, we will work out how to bridge from where we are today to that clear strategy," says Chevaucher.

Abel adds: "But it's obviously a broader discussion than just us having a discussion within the FIA. You have your partners, championship partners and existing teams."

The next few months will be as interesting as ever for World RX, from a sporting and technical perspective. But what of the medium to long term? Abel says she is keen for the discipline's highest echelons to return to having a closer synergy with domestic series than the RX1e regulations had.

"One of the main aims is to get closer to the national championships, because that's where we are getting our drivers," adds Abel. "At the moment we are not dreaming of having OEMs entering immediately from 2027. Never say never, but this is how we see it. So it means the grid has to be filled by private teams – and our aim is to get closer to the countries where rallycross championships already exist. For example one of the big markets we are missing today is France, so we're working hard on getting closer to this and to have some French drivers on the grid."

With the FIA Cross Car initiative – as a fully-regulated entry point into mixed-surface as an undercard – rapidly growing in success worldwide, rallycross could arguably have never had a better chance of building a proper 'ladder'.

At the top level, despite a turbulent period, the discipline remains perfect for both on-site and televised viewing, especially in the modern world where Gen Z consume their bitesize media hits on Tiktok, Instagram and YouTube. But, despite being craved at one stage by OEMs, the electric transition in rallycross has been met with a hostile response from its core fan base.

That ICE machines will be the headline act again from 2027 will no doubt regain fan support. Yet how the next 18 months unfolds and how the forthcoming regulation changes play out could be critical to the future of this amazing discipline. RT

ULTIMATE BOOSTED GERMANS

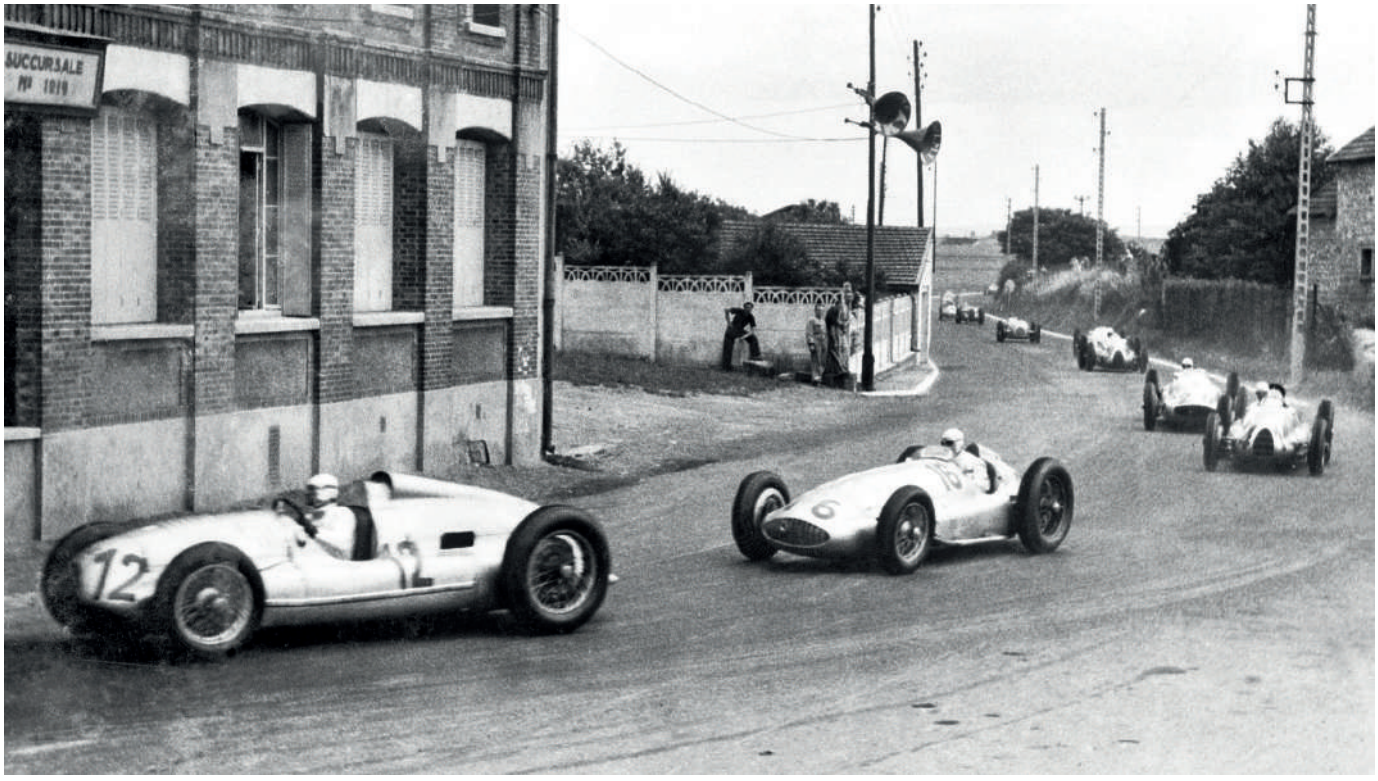
In the first of three extracts from 'Power Unleashed: Trailblazers Who Energised Engines…' award-winning author **Karl Ludvigsen** takes the reader behind the scenes of the rollercoaster ride of supercharging, turbocharging and even more exotic power-boosting inventions

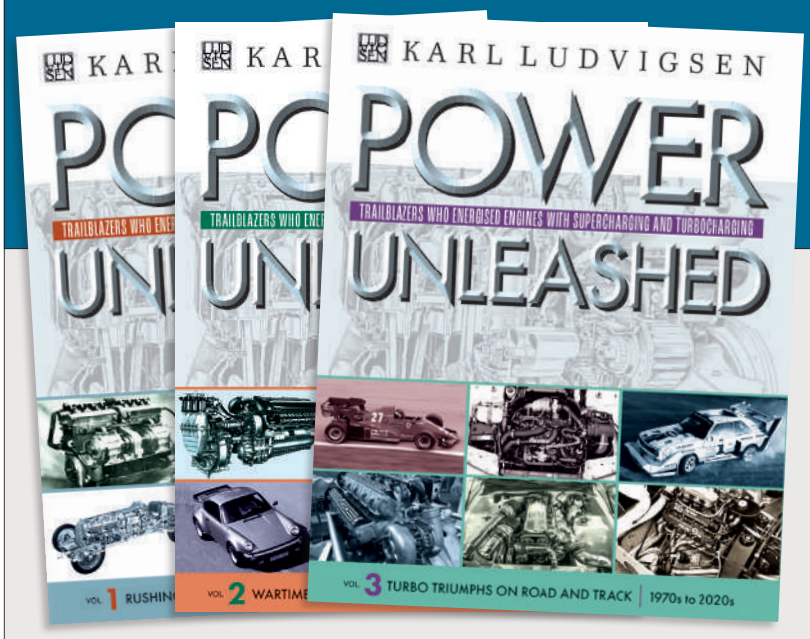
THE art and science of supercharging became even more crucial to success with the opening of the 1938 Grand Prix season. Announced by the A.I.A.C.R. in September of 1936, the new 1938 formula was the first to present designers with a choice between a small supercharged engine and a larger normally-aspirated one. It was a sliding-scale affair that optimistically linked minimum weights ranging from 400 to 850 kilograms (880 to 1,873 pounds) to variations in engine size. The latter could be from 1,000 to 4,500 cc unsupercharged or from 666 to 3,000 cc for supercharged engines. Though the formula was framed to allow different-sized cars to compete on an equal power-to-weight basis, it was soon clear to most designers that only the largest blown or unblown engines would be in the running.

For Auto Union the option was available of resizing its V-16 to the new unblown 4½-litre size—where the engine had begun life in 1934. Rumours had it that just such a version of the V-16 was tried, but chief of the experimental department Robert Eberan von Eberhorst stated that this was not the case. Porsche was no longer involved with Auto Union design, so Eberan oversaw a reduction of the V-16 concept to a 3.0-litre blown V-12.

Eberan's right hand was Werner Karl Strobel, who had headed Horch engine design since 1928 and led creation of the Horch V-12 that made its debut in Paris in 1931. The remarkable economy with which their racing engine was realised contrasted vividly with the extravagance of design and construction practised by arch-rivals Daimler-Benz.

Auto Union's 3.0-litre D-Type V-12 resembled its V-16 in its main construction features. Timing symmetry called for a 60-degree angle between the banks of the V-12, which meant




KARL LUDVIGSEN
POWER
UNLEASHED
TRAILBLAZERS WHO ENERGISED ENGINES WITH SUPERCHARGING AND TURBOCHARGING
VOL 3 TURBO TRIUMPHS ON ROAD AND TRACK | 1970s to 2020s

POWER UNLEASHED: Trailblazers who energised engines with supercharging and turbocharging

Written by **Karl Ludvigsen**.
Published by Evro Publishing.
Price: £395. ISBN: 9781910505373

In a three-volume work of astonishing depth and detail, complete with reader-friendly technical descriptions and magnificent illustrations, Karl Ludvigsen introduces the fascinating individuals who bet their businesses on boosting

RIGHT Auto Union began its 1938 season with its new supercharged 3.0-litre V-12 in a temporary body with heavy front louvring to dissipate heat from its forward radiator

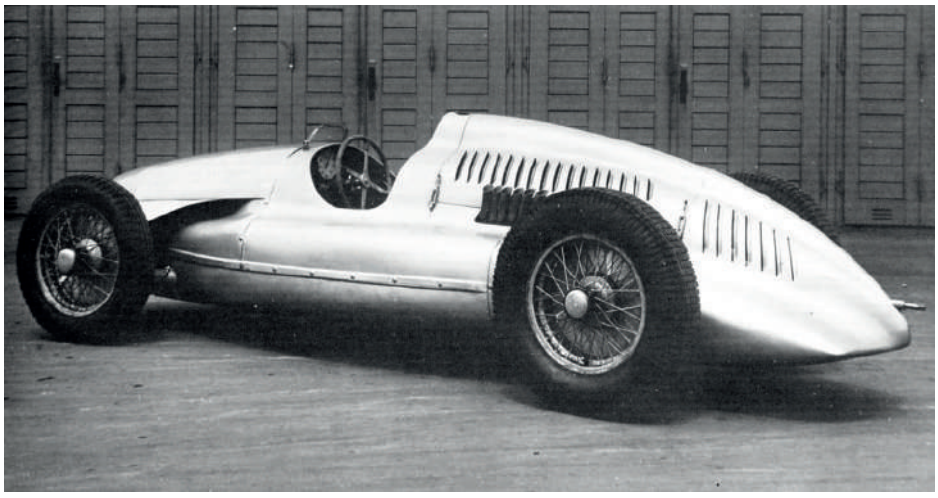
that they were too widely spread to allow the single-cam valve gear to be used. A central bevel-driven camshaft was retained to drive the intake valves through rocker arms. The bevel gear at the back of the cam drove bevels to cross shafts, out to camshafts along the tops of the exhaust valves, again working through rocker arms.

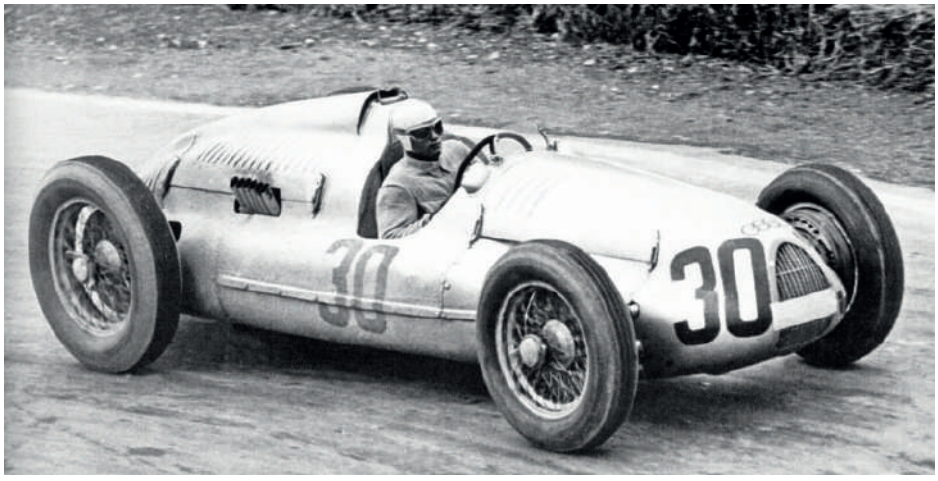
Also driven by the gearing at the rear of the engine was a new scaled-down Roots supercharger, with a housing of magnesium instead of aluminium. Displacing almost 1.4 litres per revolution, it was driven at 2.4 times crank speed—up to 17,000 rpm—to produce a boost of 1.17 bar. With this blower Auto Union's twelve developed an initial 360 bhp at 6,500 rpm. In the course of the 1938 season refinement of the blower and ancillaries raised output to 460 bhp at 7,000 rpm.

Working their magic

Auto Union's great rival the Daimler-Benz AG took several approaches to the design of a suitable engine for the new rules. To explore the potential of higher boost pressure in 1937 it bought a successful supercharged 750 cc car. It was MG's 'Magic Midget', officially designated EX 127 when it was built at the MG works at Abingdon in 1931 (see chapter 15). It had been in the hands of a German owner, Bobby Kohlrausch, who drove it to a new Class H record of 140.7 mph during the ▶

LEFT In 1938 and '39 Germany's 3.0-litre racers were the mid-engined Auto Union and front-engined Mercedes-Benz. Theirs was an epic supercharged battle for superiority





1936 Record Week at Frankfurt.

Using the larger of two Zoller blowers and the fastest drive ratio, the bronze-headed four-cylinder engine had given 147 bhp at 7,500 rpm on MG's dynamometer with a boost from an 8.0-inch Zoller of 2.69 bar. Clearly the smaller blower had been sold with the car, because on the Untertürkheim dynamometer in January 1938 its best power was 115 bhp at 7,000 rpm. Still, this was specific power equivalent to 460 bhp from a 3.0-litre engine. It was achieved with a lower compression ratio, 6.25:1, and a higher boost pressure, 1.76 bar, than the German planners were contemplating. The output achieved was highly encouraging. It was well above the 360 horsepower that was the minimum the Daimler-Benz engineers felt would be needed to be competitive.

What about the unblown alternative? With its lower fuel consumption and perhaps lower weight would it be an avenue worth pursuing? To investigate this the DBAG commissioned Ferdinand Porsche, now working for his Stuttgart neighbour, to propose unsupercharged solutions. On 1 November 1937 Porsche and his colleagues arrived in Untertürkheim with the layouts of some startling power units. Two different engine studies were based on the same broad-arrow W-24 bottom end, with three banks of eight cylinders providing 4,490 cc.

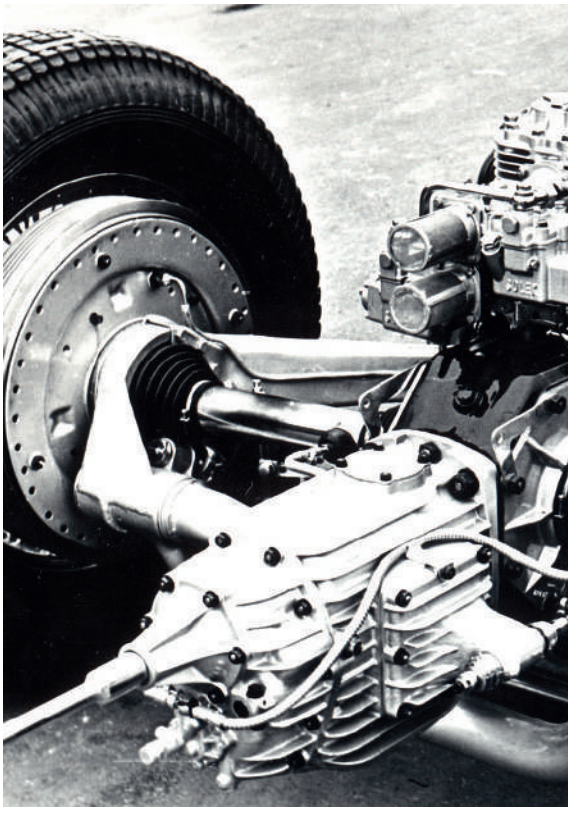
One had a conventional top end with two valves per cylinder. The other was radical, with a bulkier head design featuring piston-controlled porting, in essence an advanced two-stroke. Bosch was to supply three eight-cylinder fuel-injection pumps and four six-cylinder magnetos for each engine. Experiments with a single-cylinder test rig were carried out at Daimler-Benz in parallel with Porsche's work. Completed early in 1938, they gave no assurance that more than 305 bhp would be forthcoming from an unblown 4½-litre engine—well below the target figure.

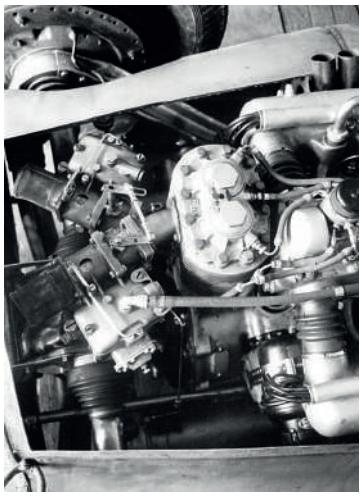
Early in 1937 the Albert Heess group prepared layouts that showed its preference for a 60-degree V-12 engine. For the new Grand Prix V-12, known as 'M154' to the design office and as 'H-series' to the men who built and assembled them, their first thought was the use of vee-splayed near-vertical blowers at the front like those of the DAB V-12. Instead, in the final design of the M154 a departure was made from the bevel-gear drive of the supercharger that had been used for every blown racing engine from Untertürkheim except the 28/95 and the M218.

Two separate Roots compressors were used, working in parallel. Their steel rotors in magnesium casings measured 106 mm in diameter—the same as the blowers of the first eights of 1934—and 150 mm in length. Protruding forward from the front of the engine, these blowers were driven

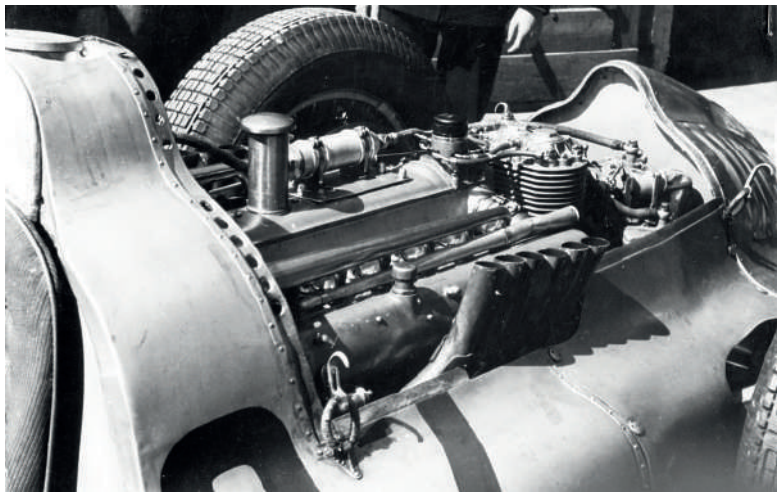
ABOVE Final Auto Union bodywork for 1938-39 dissipated radiator heat behind the front wheels. Fuel was stored along the chassis flanks with capacity of 59.5 UK gallons

RIGHT Initially feeding the single Roots charger of the 1938 Auto Union were two Solex carburettors, their venturis located one above the other and feeding the blower directly



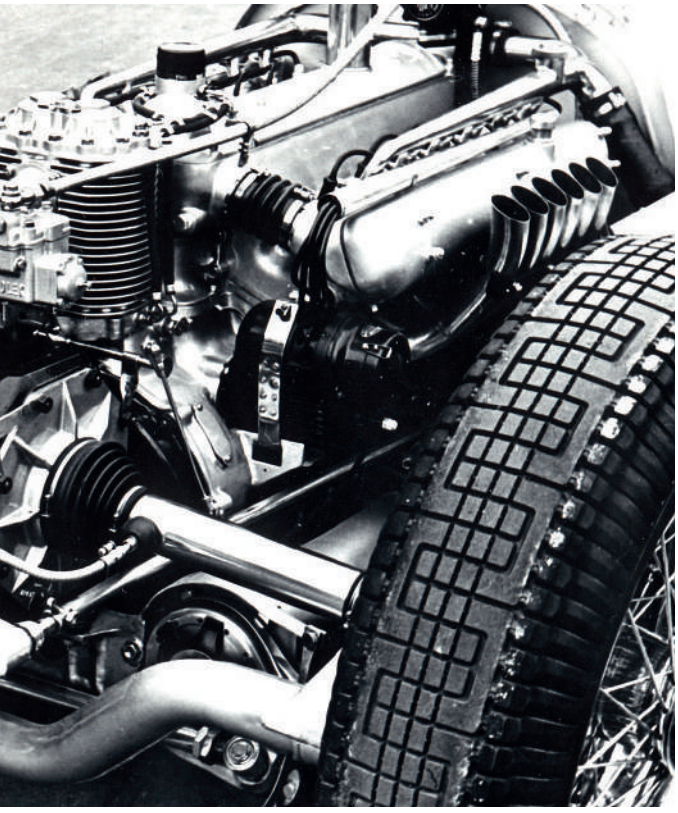


RIGHT In the final 1938 Type D Auto Union its carburettors remained stacked but splayed to the left and right to achieve better control of the effects of cornering on fuel level



FAR RIGHT Short stubs released the exhaust of the Auto Union, which had separate camshafts for its exhaust valves and a single central camshaft for the inlet valves of both banks

RIGHT Cornering at Reims with his usual decisiveness, Hans Stuck was called back to the team by Auto Union to assist in the battle against the Mercedes-Benz entries



by a train of spur gears from the nose of the crank at a step-up ratio of 1:1.5.

In preparation for the 1938 season Albert Heess invented a better way to fabricate a Roots rotor from sheet metal. He first machined a core for the rotor in the form of an X-section member whose longer wings reached out to the rotor's periphery. Steel sheets shaped to form the rotor surfaces had thicknesses to suit the stresses imposed, thin at the periphery and thicker toward the centre. End pieces and welds unified the rotor before final machining. Such elegant rotors were doubtless tested but no record shows their use in racing. As well with his colleague Hans Gassmann, Heess patented a means of sealing the blower's ball bearings so that their lubricant stayed in place under highly boosted air/fuel mixtures.

As on earlier engines, an isolation coupling was inserted between ▶

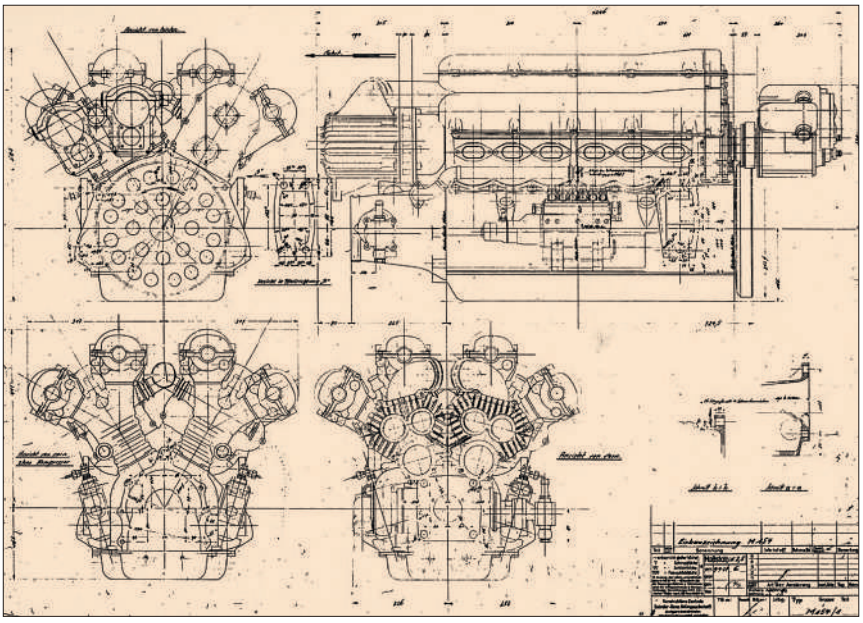
RIGHT Dubbed the 'Magic Midget' and racing at the Avus in 1934, MG EX 127 was not yet owned by Mercedes. It gave them confidence that a boosted engine was best for 1938

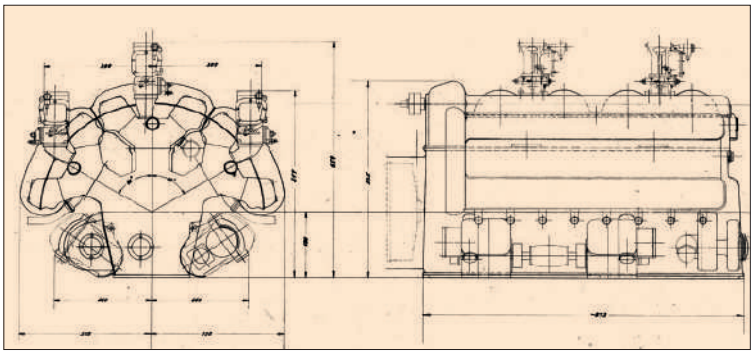
the crank and the gear train that drove through rings of coil springs in compression. Damping as well as springing was provided. A set of 13 Belleville springs formed a friction clutch intended to damp out resonance in the drive. Problems experienced with this feature during 1938 meant that it was not incorporated in later designs.

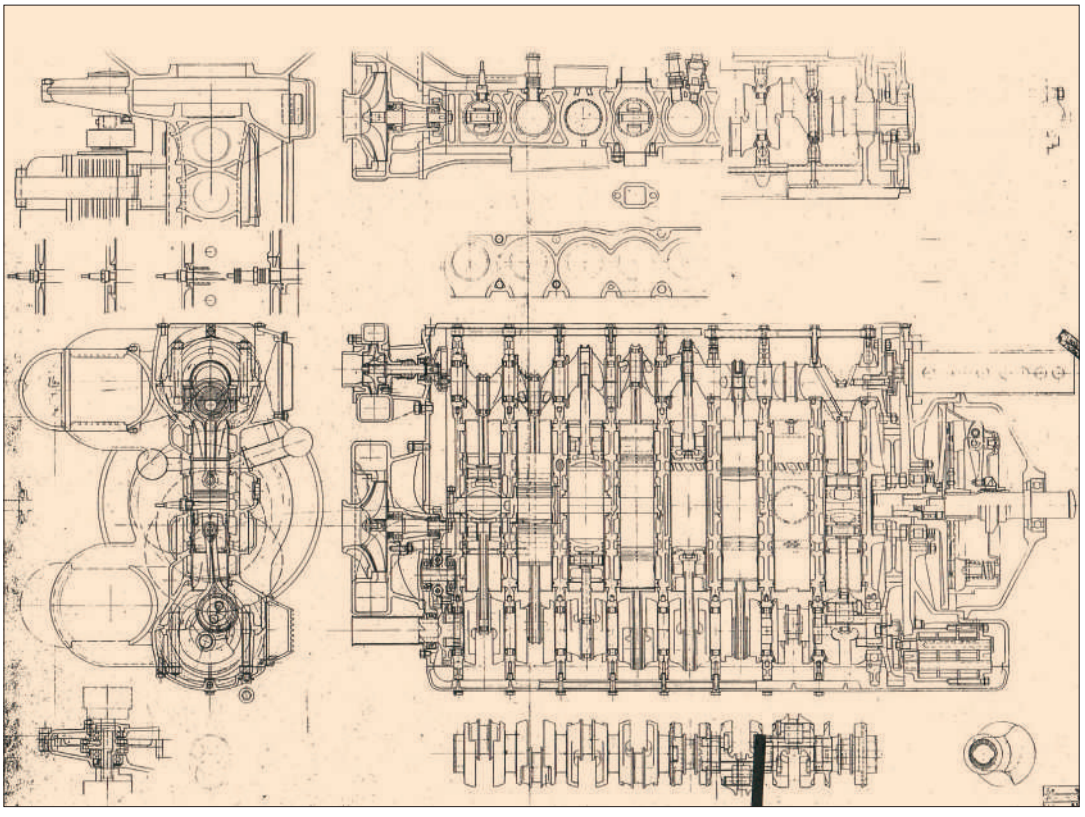
The special supercharger test stand in the *Rennabteilung* showed that the power required to drive the two blowers was 160 bhp at 8,000 rpm. Rotors of the same diameter and longer at 180 mm were tested and found to give additional boost only at low engine speeds and to require far more drive power. Their curve of required horsepower rose steeply as it passed 200 at 7,300 rpm.

As on the final version of the DAB V-12, both blowers supplied their pressurised air-fuel mixture to a single central manifold from which individual branches led downward to the oval inlet ports. As it had been used successfully on the 1937 F-series eight, the Scheerer system of manifold scavenging or 'liquid fuel recirculation' was applied to this manifold to balance out the spark-plug needs of all the cylinders.

DAB experience was applied to the carburetion also. In the search for ultimate power, Georg Scheerer noted, the highly alcoholic W.W. fuel



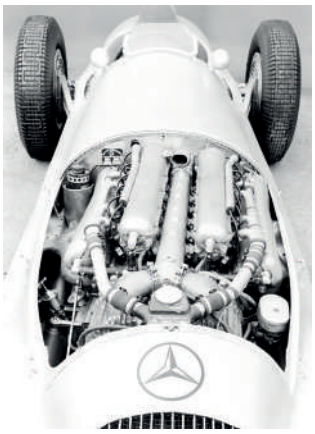


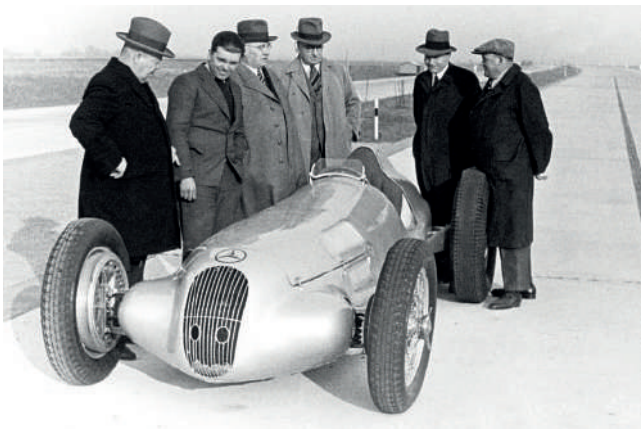


ABOVE Untertürkheim's choice for the new racing rules was a 60-degree V-12. Each bank of six cylinders had its own Roots blower and, as pictured, direct fuel-injection system

ABOVE LEFT Although it is irrelevant to our topic, this was the installation package of the Type 94 W-24 proposed by Porsche as the 4½-litre unblown alternative to its Type 1091938

LEFT One of Porsche's boosted proposals for Mercedes-Benz for 1938 was a flat-eight two-stroke with two crankshafts in the Junkers fashion. Its Type 109 was not accepted





would have to be used almost exclusively. However, Scheerer had found it 'not only difficult, but virtually impossible' to get an accurate indication of mixture quality from the appearance of a spark plug when running on W.W. To ward off burning of the new engine's pistons Scheerer was planning to apply to the M154 some of the new carburetion principles he had developed on the DAB V-12.

The supplementary carburettor, the *Zusatzvergaser*, made a return engagement on the M154 twelve. Initial tests were run with two horizontal 58 mm Solex carburettors like those used on the big V-12 DAB while the special single-housing Daimler-Benz carburettor for this engine was being completed. The first samples were ready in time for use in the March 1938 Monza trials, conducted with a single chassis and two consecutive engines.

Within a single aluminium housing the central design office combined all the important elements of the various carburettors that had been developed in 1937 for the DAB and F-series engines. At the ends of its long aluminium casting were the two horizontal throats that fed the two superchargers, each with its own float bowl. The Automat principle of a moving outer venturi was retained, now with the venturi lying on its side and controlled by springs instead of gravity. Each throat had three progressive jets: idle, main and supplemental. A typical Automat venturi diameter in 1938 was 49 mm.

In the centre of the carburettor a single barrel valve was placed, a *Drehschieber*, its axis of rotation vertical and containing, as before, the large fuel jet of this *Zusatzschiebervergaser*. Its valve was opened and closed by supercharger boost pressure, acting on a sliding piston mounted on the inlet manifold. To assure an adequate fuel supply to its big jets, in spite of the narrow passages of this long carburettor, the bypass valve in the fuel pump was locked shut under full load so that its full output was piped to the float bowls, overcoming any resistance by the floats and needle valves. One way or another sufficient fuel would be there.

This complex carburettor served with quiet competence during 1938 and the early months of the 1939 season. Tests with and without the supplementary barrel-valve carburettor during 1938 showed, in Georg Scheerer's words, that with it in use 'the power is higher with approximately the same specific fuel consumption' and also 'the supercharger pressures are somewhat higher than without it.' This looked like an attractive speed secret for the new engine.

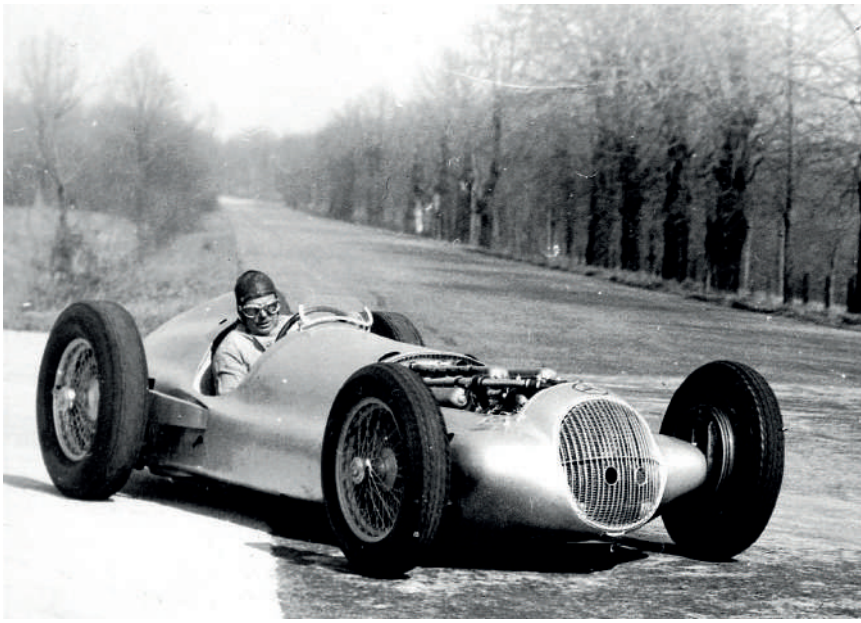
On 7 February 'Papa' Scheerer made the first complete power run with the new V-12. On W.W. fuel—used for all subsequent pre-war tests with few exceptions—it delivered 325 lb-ft of torque at 5,000 rpm and reached 427 bhp at 8,000. The boost pressure attained 1.31 bar at about 5,000 rpm and remained steady at that level all the way to 8,000—a sign of the limitations of the Roots compressor. During spring 1938 tests at Monza, however, the piston controlling the Zusatzvergaser froze in its bore. With ▶

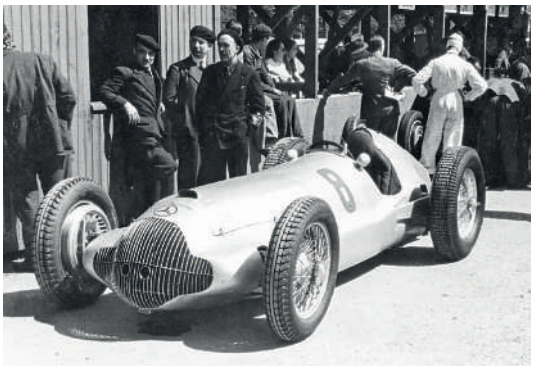
ABOVE LEFT Installed view of M154 shows angle of drive train to allow lower seating. Pristine M154 has rear backfire vent while other has forward exit with piped escape for gases

ABOVE CENTRE The Mercedes engineers designed their own carburettor for the M154, embodying a separate venturi for each blower and at its centre the power-adding Schiebervergaser

ABOVE RIGHT From left Albert Heess, Rudolf Uhlenhaut, Max Sailer, Max Wagner, George Scheerer and Jakob Krauss admired their ultra-low G.P. W154. Uhlenhaut had the right to smile

BELOW Without its bonnet Rudy Uhlenhaut probed the weaknesses of the new engine and 1937-type chassis at Monza. Inadequate cooling suggested a new and wider grille



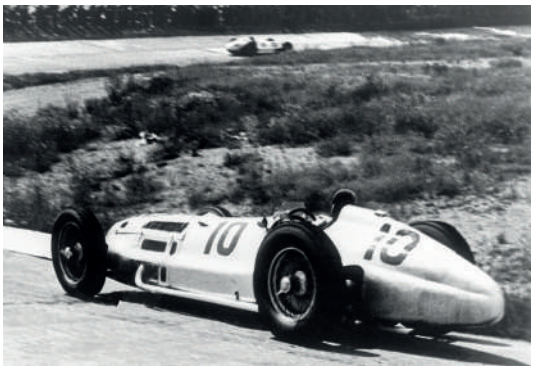


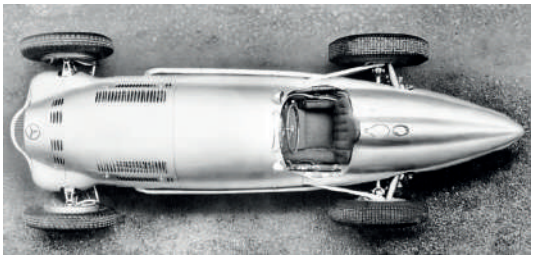
LEFT In its race-ready format the W154 was a new concept of racing car. One hole in its grille was for the electric starting motor and the other provided aesthetic symmetry

RIGHT The banked curve after the start/finish line at the Nürburgring showed off the W154's lines. They changed during 1938 with experiments of fuel-tank size and position

LEFT On one of Italy's fastest circuits at Pescara, Rudi Caracciola exploited the W154's speed. Lightening measures included apertures in the de Dion tube's radius arms

ABOVE RIGHT Mercedes-Benz engineers masterfully managed to keep the driver in the middle while angling the drive shaft to the left of his seat to create the W154's overall lowness





no recurrence during the Monza tests, this was judged a random failure.

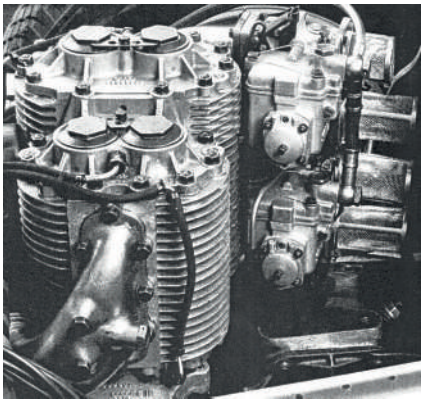
With a 6.0:1 compression ratio and its final camshaft design the M154 produced 453 bhp at 8,000 rpm. Hermann Lang's engine for the French G.P. at Reims showed the highest reading obtained all season: its 1.45-bar boost and 6.6:1 compression ratio gave it 474 bhp at 8,000 rpm. After the imposition of a firm ceiling on compression ratios at 5.95:1 in the interest of reliability, late-season engine output was only slightly higher than it had been at the start. Engines sent to Donington Park in October produced between 433 and 444 bhp at 8,000 rpm.

A heavy penalty was paid in the form of an appetite for fuel. These were extravagantly thirsty cars. 'Stepping up the power,' said Uhlenhaut, 'meant that we had to cool the pistons with fuel, which is why the consumption was so high and it was hard to get it all into the car.' Their mileage in competition was rarely better than 2.4 miles per US gallon and the normal range was between 1.9 and 2.3 mpg, with Rudi Caracciola almost invariably getting the best mileage.

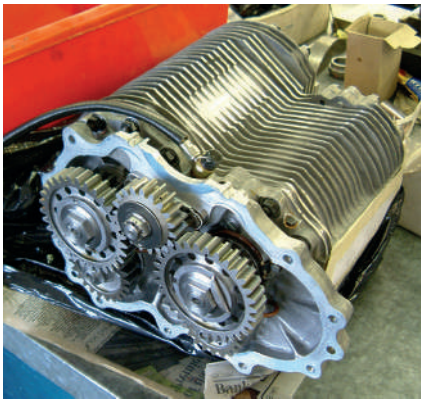
The limitations of the Roots blower were all too evident to the research-minded engineers at Auto Union. At boost levels around 1.5 bar the Roots was at a point of diminishing returns. Tests they had run in 1936 showed that the C-Type blower required 80 horsepower to drive it. The figure was even higher now. Thus they went to work in 1938 on a two-stage layout, using two Roots blowers in series to compress the mixture progressively, giving improved drive efficiency. Even if the final boost achieved is no greater than that realised with a single-stage system, each blower in a two-stage layout is operating at a much more favourable point on its efficiency curve so the total power required to drive them is reduced.

The smaller, second-stage blower was a shorter-lobe version of the one used in the 1938 Auto Union, ▶

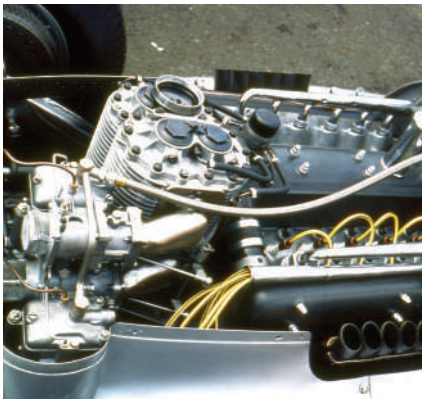
BELOW With the aim in view of gaining power by reducing the amount lost to drive the blower, Auto Union introduced a two-stage charger during the 1939 season



BELOW Viewed from the underside and back of the magnesium Auto Union charger housing, the two-stage blower showed the driving gears below the paired gears of each Roots



BELOW Fed by side-draft carburetion, in the 1939 D-Type Auto Union the larger Roots supplied its smaller sister. Carburetion was by controlled fuel levels instead of floats



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displacing 1.2 litres per revolution. It was driven from the same idler gear as before but swung around 90 degrees so that the charge passed through it from right to left, thereafter being ducted forward into the engine. To the right of it was the larger first-stage blower. A shorter edition of the S-series supercharger used on the V-16 engines, it swept 2.25 litres per revolution.

Both blowers were driven at 1.63 times engine speed, delivering a 1.66 bar supercharge. So equipped the V-12 produced 485 bhp at 7,000 rpm. It could attain 500 bhp at 7,500 rpm, although this was not always used in racing. Peak torque was 405 lb-ft at 4,000 rpm, a remarkably low speed for a racing engine.

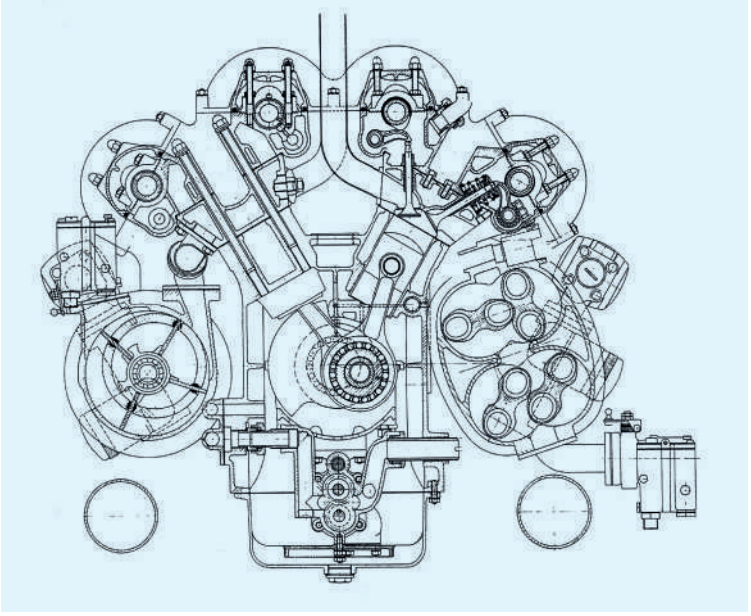
The D-Type started out with Solex carburetion using three identical units, two of which operated at all times and one that came on stream at peak power demand. For 1939 Auto Union worked with SUM to make a four-throat float-free instrument. Each jet block drew from a chamber which was kept full by one fuel pump and was constantly tapped off, at a precise level, by a second pump. All four throats were controlled by a single vertical barrel-type throttle valve, arranged so that it progressively uncovered a second main jet as it opened.

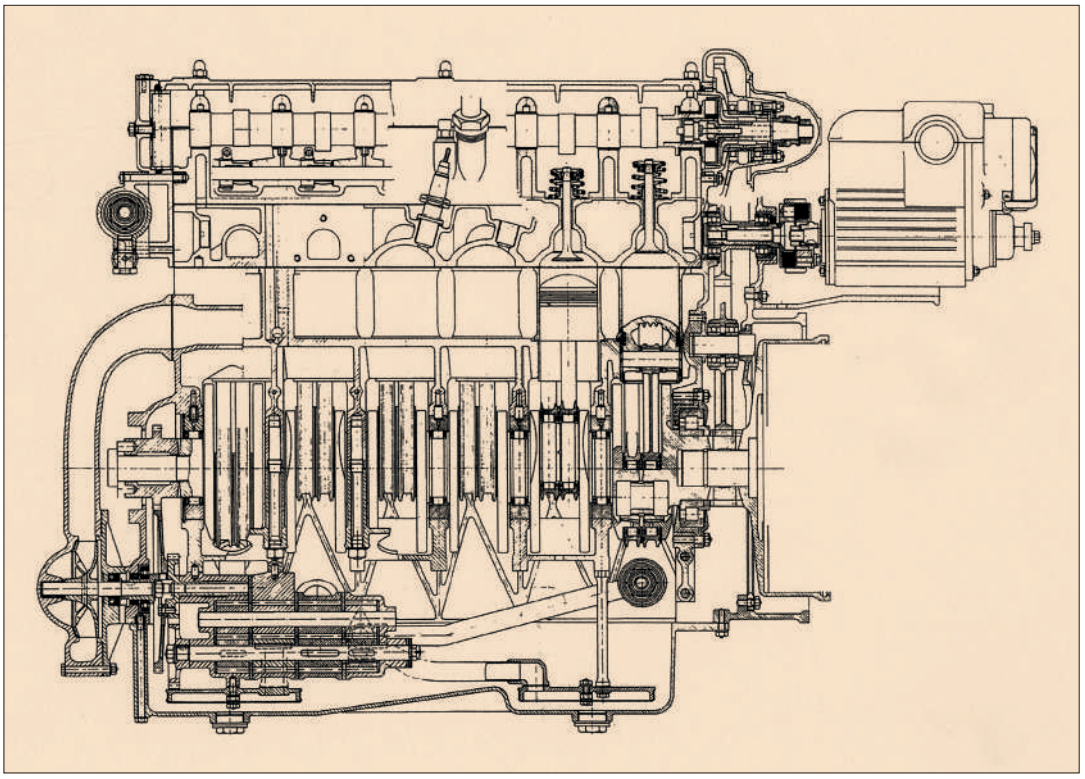
For Robert Eberan von Eberhorst the two-stage Roots blower was only a stopgap until he could perfect a vane-type supercharger which, with its internal compression, is more efficient. Based on the British Centric design, a pair were being developed in 1939 for use on the planned 1½-litre V-12 E-Type Auto Union engine. Designed as the Type 537, this was to have 1,483 cc to provide an entry in the increasingly popular Voiturette category, which was being trailed as a likely Grand Prix formula for 1941. It was hoped to have a car ready to compete during 1940.

SUM delivered a sample of its special carburettor with three throats for the smaller engine, while tests of fuel injection were progressing in 1940 on a 3.0-litre D-Type V-12. A special Schenk dynamometer to cope with the 1½-litre's higher speeds was on order and expected by the end of 1939.

ABOVE To supply the air demanded by the two-stage Roots system, scoops were added that ducted air to the 1939 Type D's carburettors—also on this replica of an original car

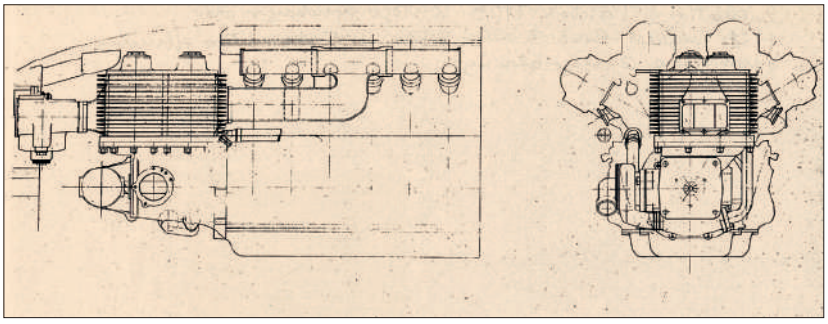
BELOW Auto Union's V-12 engine planned for the expected 1½-litre limit was shown with both types of contemplated blowers, vane on the left and two-stage Roots on the right

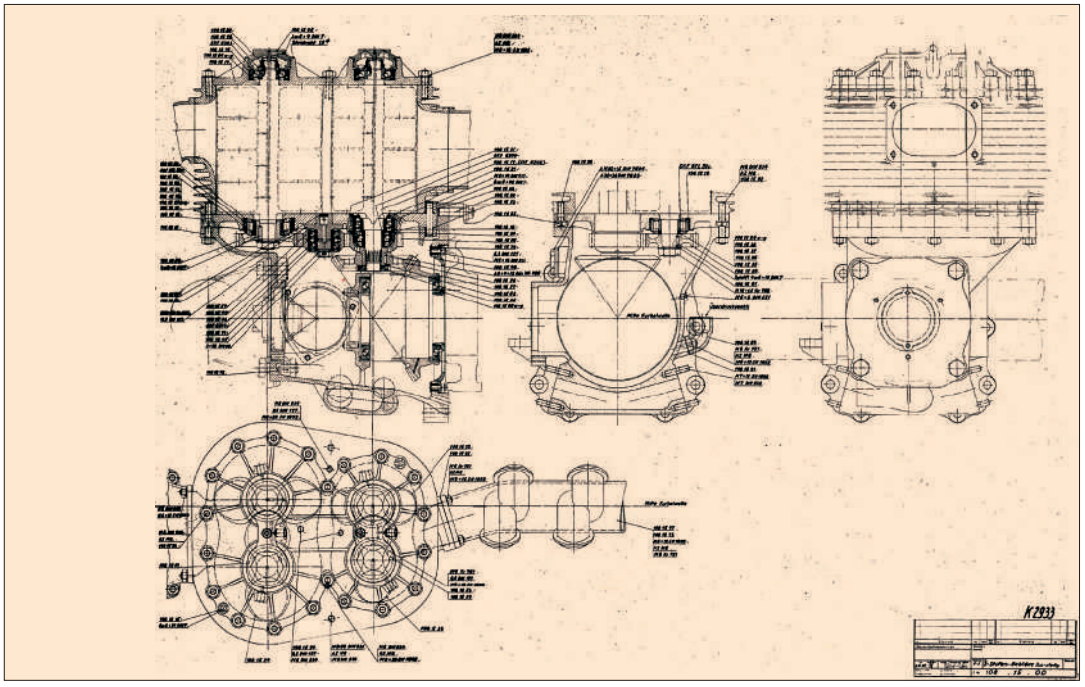




LEFT This view of the Type 537 V-12 planned by Auto Union for its E-Type in 1940 showed gear-type cam and blower drives at its flywheel end near an extra-large roller bearing

An ultra-high compression ratio of 10.0:1 and output approaching 300 bhp at 8,500 rpm were foreseen for Auto Union's Type 537. The E-Type's twelve was well along in construction in 1940, with single-cylinder tests under way, new valve gear proven with an 80-hour test at 11,400 rpm and casting patterns made, and indeed into 1941. Only in the second half of that year was it evident that Germany's motor industry had to devote all its attention to the war effort. RT





ABOVE & LEFT Porsche's experimental Type 108 twin-blower array for Mercedes-Benz had rotors of equal length and differing diameter. Its design fitted to the front of the M154 twelve

Eric Le Galliot / MPSA

LEFT The Le Mans Classic showcased a wonderful selection of cars

HISTORY LESSONS

Sergio Rinland marvels at some of the technology – good and bad – still capable of turning heads at the racetrack

SPANISH philosopher George Santayana famously coined the aphorism: "Those who cannot remember the past are condemned to repeat it." In motorsport, however, there are moments when you actually *want* to repeat history, though it is rarely successful.

History, particularly motorsport history, is one of my passions. That is why I attend the three Goodwood events and the Silverstone Classic every season. This year, I added the Le Mans Classic to my list, a truly wonderful event held every two years at Le Mans, two weeks after the 24 Hours race.

It is always a pleasure to drive down to Le Mans and arrive in the town centre, where Steve McQueen famously pulled up in his black Porsche 911 in the film 'Le Mans'. This year, the Classic coincided with a local music festival, so Place des Jacobins was absolutely packed.

The event was fantastic. The paddock was divided into six grids, each representing an era from Le Mans' more than 100-year history.

Grid 1 (1923–1939) featured the legendary Bentleys from 1927 to 1930, which won Le Mans under Barnato and Birkin, supported by their team-mates, the famous "Bentley Boys". They were beautifully restored and running as if it were the Roaring Twenties all over again. Also present were stunning Alfa Romeo 8Cs and Bugatti Type 57s, all victors of their time.

Grid 2 (1949–1956) showcased the emergence of Ferrari and Porsche as manufacturers, with exceptional examples racing with real spirit.

Grid 3 (1957–1961) brought together impressive entries across categories, from nimble small-displacement sports cars to some magnificent Ferraris of the era.

Grid 4 (1962–1965) captured the struggle of Ford trying to beat Ferrari, with fine specimens of the Lola T70, Cobras, and GT40s.

Grid 5 (1966–1971) represented the era immortalized in 'Ford v Ferrari' (1966) and 'Le Mans' (1970), what I consider the golden age of the 24 Hours, peaking in 1971, when Porsche finally took overall victory with the 917. I missed one of the most beautiful cars of that era, in my humble opinion, the Ferrari 330 P3 and P4.

Grid 6 (1972–1981) marked the period when the governing bodies attempted to rein in speeds by limiting engines to three litres (unsuccessfully, as always!). Ferrari, Matra, Porsche, Alpine and Alfa Romeo built remarkable machines. In the case of Ferrari, Matra and Alfa Romeo, they were essentially two-seater Formula 1 cars, dominating until Group C arrived and the Porsche 956 returned the marque to the winner's podium.

All in all, an absolute treat for someone who has followed Le Mans passionately from a young age. A rainy Sunday morning visit to the Le Mans Museum was the cherry on top of this year's trip.

If that wasn't enough to satisfy my appetite for history, the following week brought the Goodwood Festival of Speed, celebrating 75 years of the Formula 1 World Championship and Gordon Murray.

The range of Formula 1 cars from 1951 to present was breathtaking, driven by original drivers or their sons, like Sir Jackie Stewart's son, Paul. Seeing these cars, it's no wonder so many of those heroes are no longer with us. They were incredibly brave, or perhaps not fully conscious of the risks they faced.

Nothing illustrates the dangers of those early racecars more vividly than the Porsche 917/30 Can-Am: over 1,000 horsepower from a monstrous turbocharged flat-12 behind the driver, with 200 litres of fuel on each side, the driver's feet ahead of the front axle just behind the oil radiator, all housed in a pressurized aluminium tube spaceframe.

That setup prompted one of the most memorable anecdotes from the genial Frank Gardner: "These 917s had alloy tubular chassis, which were gas-filled to detect cracks. There was a big gauge in the cockpit measuring the gas pressure. If the gauge zeroed, they said it meant the chassis had started to crack, and I should drive home 'mit care'. I told them, 'If the needle zeroes, I'll park the bastard there and then, walk back, pick up my Deutschmarks, and go home.'"

I've never seen such a crowd at Goodwood: absolutely packed! Nearly impossible to move, especially near the Formula 1 paddock. What truly warmed my heart was seeing so many young people: couples with children, kids pointing out car details to their parents, just like I witnessed at the Le Mans Museum. In an age where young people often seem disinterested in history, that was a joy to see.

I teach in the Motorsport Master's programme at Oxford Brookes University. On the first day of term, I always tell my students: Read history! Because, as Santayana said, "Those who cannot remember the past are condemned to repeat it." And while there are certainly moments in history we'd love to relive, there are just as many, like the porpoising in F1 2022, that we'd prefer not to revisit.

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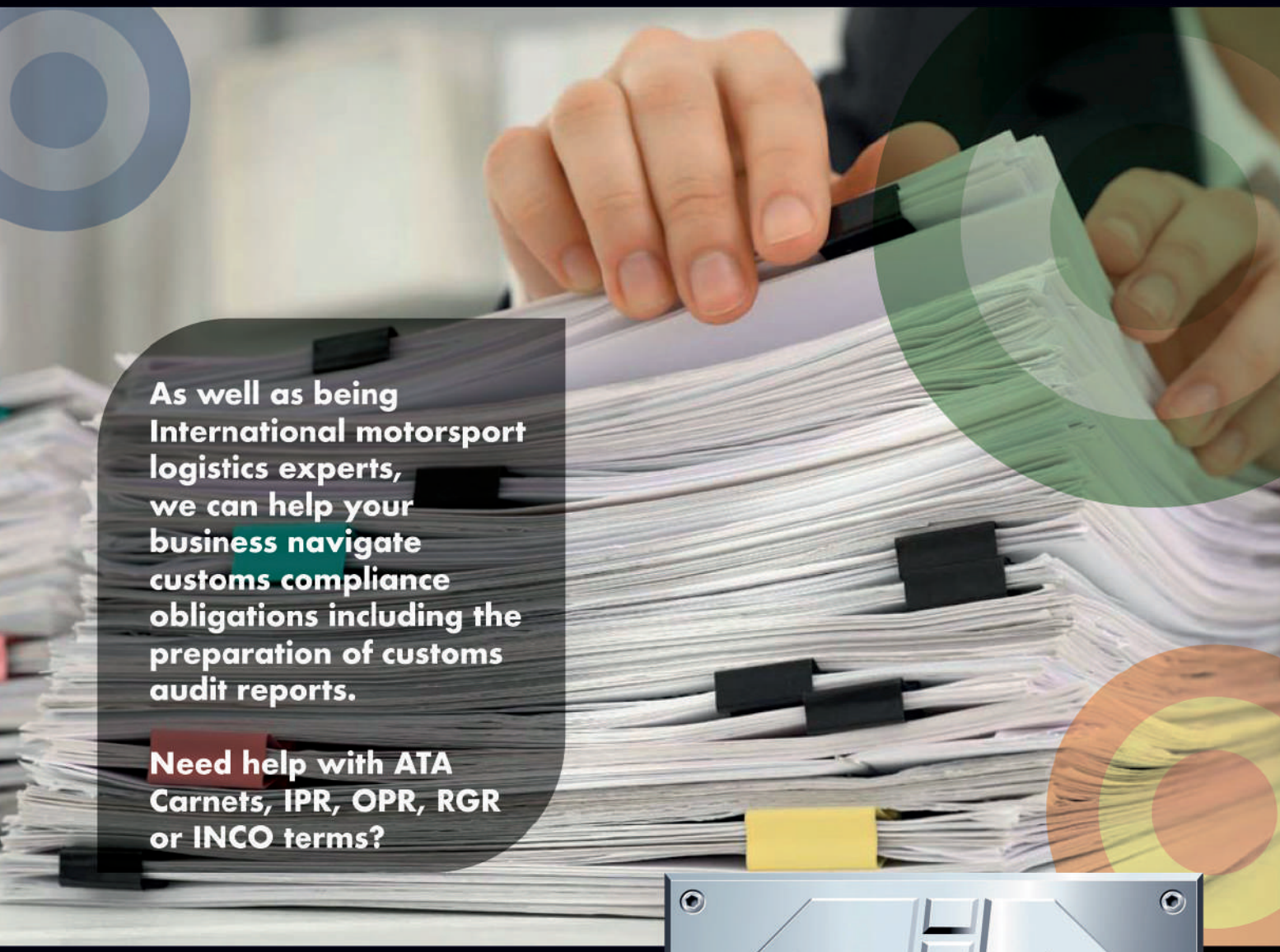

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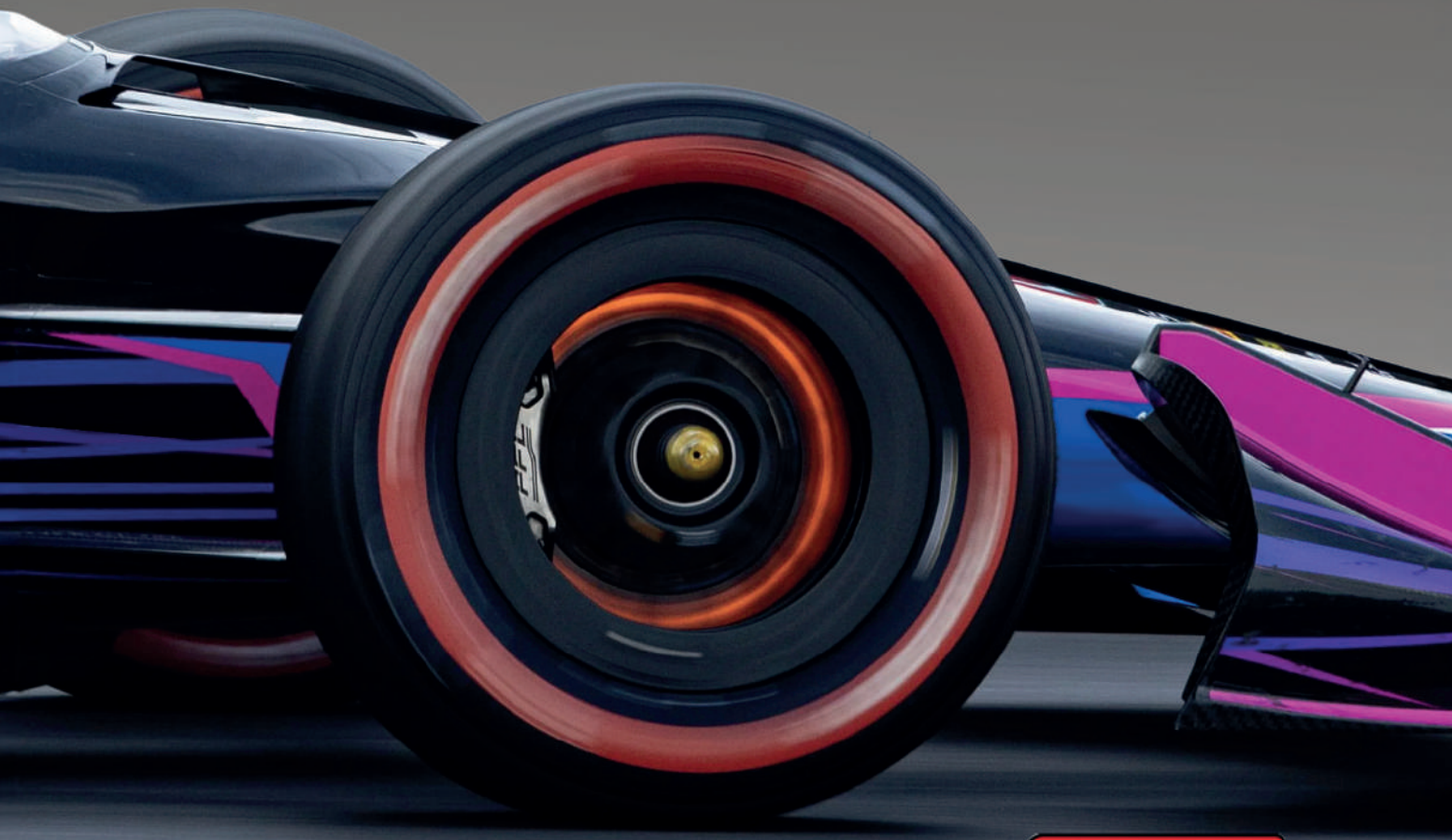

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